October

25 Cents

THE NEW Science and Invention

IN PICTURES

$12,000 IN PRIZES FOR PICTURES

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ELECTRIC FLAMING LOGS

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ELECTRICITY

Let Me Show You How to Make It Bring You $9000 a Year

You men who are slaving away in small-pay jobs, hoping and striving for better things, I wish you could be with me here for just a few moments. I would show you how thousands of men just like yourself have quickly stepped into high-salaried positions and brilliant success in this fascinating field of electricity. In each and every case, their first step toward this cherished goal was to write to me for the same *free proof* I want to send to you. They followed my advice and today are leading happy, prosperous lives—many drive their own cars, own their own homes and have plenty of money to spend for the other good things in life! They are Electrical Experts—"Cooke Trained"—earning $3500 to $10,000 a year!

$9000 A Year

The picture above shows Mr. W. E. Pence of Chehalis, Washington, in his working togs. Pence is a "Cooke-Trained" man, and his letter below shows what he thinks of my course.

Dear Mr. Cooke:

Thought you would be interested in a hand-bill I have just gotten out regarding my new shop. Business is going strong, paying me now something over $750 a month above my expenses.

And I must thank you again for my success, because it was your wonderful Course and method of instruction that put me where I am.

Your true friend,
W. E. PENCE.

Be an Electrical Expert Learn at Home

Get into this great field of Electricity! Know this magic force, the ways and means it is harnessed for use in industry, and a thousand jobs will be opened to you at salaries far beyond your fondest dreams. Read Pence's story at the left! Let it be your guide post to success! Hundreds of other Cooke-Trained men have done as well, and many better! And how? Simply by taking this specialized training that quickly fits any man, no matter what his age or previous education, to take his place with the big-pay men of the country. You needn't give up your present job or go away to school, by this amazing method you may *learn right at home in your spare time.*

$3500 to $10,000 a Year

Twenty years of actual work all over the world in the electrical field gave me a grasp of just what a man must learn to fill an important position. My experience taught me that a man must know first the principles involved and then the *best methods* to apply and regulate those principles. Why make a man wade thru a lot of useless study, wasting months of precious time? And so, at enormous expense and years of effort, I evolved a system of training that is stripped of every useless step. I will make the student a practical worker! I will place in his head and hands the means to make big money as a skilled Electrical Expert! I will fit him in a *short time* to earn a princely salary, $3500 to $10,000 a year for his skill!

Thousands of Happy Men Say "There Is No Other Training Like This"

"You have given me a most wonderful training, a training no other school can, I feel sure, approach, much less duplicate," says F. E. Radcliffe, one of my boys who is making good in Ohio. I wish you could see the thousands of letters I get like this! John Burke of Baltimore *made* $750 *in* spare time before he finished his training! Think what this means to you! No frittering away time serving a costly apprenticeship! Every step in this fascinating training adds earning power. You quickly become a practical man, ready to fill a big-pay job.

Many of my boys set up in the Electrical Contracting business, wiring houses, repairing motors, generators, electrical appliances, installing farm lighting systems, etc. Others set up shops and spaces in garages for repairing electrical systems on automobiles, trucks, motorcycles etc. They are fitted at once to start in business for themselves, with practically no investment. And with the big plants, even the ordinary electrician makes good money. But the Trained Expert is the man who is *Boss*—he is the big-pay man. With this training behind you, you can claim such an enviable place for yourself.

You Cannot Lose—I Guarantee Your Complete Satisfaction

You don't have to take my word for one thing. So sure am I that after taking this training you can step right into a high-salaried position, and you will thrill with the newly found power that is yours, that I guarantee under bond to return every cent of tuition you pay me, if you are not absolutely satisfied that it is the best investment you ever made. Electricity needs you—it offers you boundless opportunity for a brilliant career. I have tried to remove every stumbling block toward accomplishing your ambition. I will help you win, if you will let me!

FREE—If You Act Now—FREE Big Electrical Outfit

I know that it is only by practice with actual instruments and materials that a man can become a ***practical electrical expert.*** For that reason I give you without charge or stipulation a Complete Outfit of Electrical Tools, Materials, and Measuring Instruments. I also furnish you with supplies, examination paper and many other things that other schools don't furnish. You actually start early in the course to work at your profession, rapidly becoming proficient, ready to do any electrical job.

EXTRA—A Course in RADIO Given FREE for a Short Time

The up-to-date Electrical Expert must know radio or wireless work, how to make and repair the various equipment. This is a mighty profitable field today, and many men are making big money in it. Because I want to make this my banner year, I am now giving this $45.00 Course in Radio *absolutely Free* to new students. Don't miss this remarkable offer which might be withdrawn at any time.

Make up your mind now to get into this great profession quick. Every day lost keeps you away that much longer from prosperity and happiness! Mail the coupon today for my big free book, "How to Become an Electrical Expert." And other free proof that I can put you into the class with Pence and thousands of other Cooke-Trained men who are making princely incomes!

L. L. Cooke, Chief Engineer,
Chicago Engineering Works,
Dept. 27, 2150 Lawrence Ave., Chicago, Ill.

MAIL COUPON TO-DAY

YOUR PASSPORT TO SUCCESS

L. L. Cooke, Chief Engineer, Chicago Engineering Works, Dept. 27, 2150 Lawrence Ave., Chicago, Ill.

Send me at once "How to Become an Electrical Expert" with other proof that I can become a big-pay Electrical Expert through your Training. Register me for your Special Free Offers. You send this FREE without any obligation on my part.

Name .....

Address .....

..... State .....

The "Cooke" Trained Man is the "Big Pay" Man

If New Hair Doesn't Grow After Using My Method —*I Don't Want a Penny!*

I mean just exactly what I say! I don't care how thin your hair may be—I don't care how many treatments you have taken without results. If my new disovery won't restore your hair, I don'twant to keep a cent of your money! Furthermore I'll send you the proof of what I have done for others entirely FREE! Just mail the coupon below.

By ALOIS MERKE

Founder of Famous Merke Institute, Fifth Ave., New York

AFTER 17 years' experience in treating baldness— which included long years of experimentation in Heidelberg, Paris, Berlin, Geneva, Cairo and other centers of scientific research—I have discovered a startling new way to promote hair growth.

At the Merke Institute, Fifth Avenue, New York — which I founded — I have treated scores of prominent stage and social celebrities. People are coming to me from all parts of the country to gain the benefits of my discovery. Many pay as high as $500 for the results I have brought them.

Yet now, through a series of ingenious inventions, I have made it possible for every one to avail themselves of my discovery—right in their own homes, and at a cost of only a few cents a day!

My Unusual Guarantee!

I know you are skeptical. I know that you have tried perhaps dozens of different remedies and treatments without results. I know that you have wasted time and money on treatments which by their very nature could NEVER restore your hair. All right. Perhaps my treatment cannot help you, either. I don't know. But I do know that it has banished falling hair and dandruff for hundreds of others—often with the first few treatments. I do know that it has already given thick, luxuriant hair to people who long ago had despaired of regaining their hair. And I am so downright positive that it will do the same for you that I am entirely willing to let you try it at my risk—and if it fails to restore your hair, then I'll instantly—and gladly—mail you a check, refunding every cent you have paid me. In other words, I absolutely GUARANTEE to grow new hair on your head—and if I fail, then the test is free.

Entirely New Method

What is my method? It is entirely new. It is entirely different from anything you ever heard of. No massaging—no singeing—no "mange" cures—no unnecessary fuss or bother of any kind. Yet results are usually noticeable even after the very first few treatments.

Many people have the idea that when the hair falls out and no new hair appears, that the hair roots are always dead.

I have disproved this. For I have found in many cases which have come under my observation that the hair roots were NOT dead, but merely dormant! Through undernourishment, dandruff and other causes, these starving, shrunken roots had literally gone into a state of "suspended animation." Yet even if the scalp is completely bare, it is now possible in the majority of cases to *awaken* these dormant roots, and stimulate an entirely new growth of healthy hair! I KNOW this to be true—because I do it every day.

Ordinary measures failed to grow hair because they did not penetrate to these dormant roots. To make a tree grow, you would not think of rubbing "growing fluid" on the bark. Instead, you would get right to the roots. And so it is with the hair.

In all the world there is only one method I know about of penetrating direct to the roots and getting nourishment to them. And this method is embodied in the treatment that I now offer you on my positive guarantee of satisfactory results, or the trial costs you nothing. The treatment can be used in any home in which there is electricity.

Already hundreds of men and women who only recently were bald or troubled with thin falling hair, have through this method, acquired hair so thick that it is the envy and admiration of their friends. As for dandruff and similar scalp disorders, these usually disappear after the first few applications.

Remember—I do not ask you to risk "one penny" in trying this treatment. I am perfectly willing to let you try it on my absolute GUARANTEE — and if after 30 days you are not more than delighted with the growth of hair produced, then I'll gladly return every cent you have paid me. I don't want your money unless I grow hair on your head.

Free Booklet Explains Treatment

If you will merely fill in and mail the coupon below I will gladly send you—without cost or obligation—an interesting 32-page booklet, describing my treatment in detail.

This booklet contains much helpful information on the care of the hair—and in addition shows by actual photographs what my treatment is doing for others.

No matter how bald you are—no matter if you are completely bald, this booklet will prove of deepest interest to you. So mail the coupon now—and it will be sent you by return mail.

ALLIED MERKE INSTITUTES, Inc.,
512 Fifth Avenue., New York City, Dept. 4610

Actual Results

(Dozens of letters like the following are received every day by the Merke Institute.)

"In the short time I have used your treatment I have gained remarkable results. Dandruff has disappeared entirely. My scalp is now all full of fine new hair. Would not part with my treatment for 10 times its cost." A. W. B.

"The top of my head is now almost covered with new hair about one-half inch long. I have been trying five years, but could never find anything to make my hair grow until your treatment." T. C.

"Ten years ago my hair started falling. I used hair tonics constantly, but four years ago I displayed a perfect full moon. I tried everything—but without results. Today, however, thanks to your treatment, I am pleased to inform you that I have quite a new crop of hair one inch long. My friends are astonished at the result." F. H. B.

ALLIED MERKE INSTITUTES, Inc., Dept. 4610,
512 Fifth Avenue, New York

Please send me, without cost or obligation on my part, a copy of the new booklet describing in detail the Merke Institute Home Treatment.

Name .....

Address .....

City ..... State .....

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FORMERLY

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Great Inventors now teach you secrets of practical invention

How would *you* like to be the inventor of the tin cap that now corks millions of bottles—and who gets a royalty on every one? How much money would *you* have now if you had invented the simple idea of putting a rubber tip on pencils? The inventor of the Gillette Safety Razor is said to have made as high as $2,500,000 *a year!* The inventor of the tiny snap fastener last year paid an *income tax* of $29,000. The man who invented the Autographic Kodak sold his patent rights for $300,000!

JUST one single idea can make *you* independently wealthy in a short time. Little things — like the crimped hairpin, the paper safety-match, the metal-tip shoelace—brought their inventors hundreds of thousands of dollars. Only recently "Success Magazine" told how one woman built up a splendid business from an invention based on a little wedge-shaped piece of wood!

Couldn't *you* develop an invention as simple as these? Haven't *you* some ideas—even now—for one of these little inventions which can pay you so much money? Just one little idea can bring you fame and fortune. The world is waiting for new inventions and it will pay handsomely for even the simplest idea.

Raymond F. Yates, who with fourteen other famous inventors, now makes it easy for you to learn how to invent in your spare time at home.

What Invention Is

After all, invention is nothing more than the science of "fixing things." And how many times a day you do "fix things". A leaky faucet, a rattling window, a broken strap—you fix hundreds of things just like these almost every day. You may not know it, but when you "fix things" you are actually using the laws and principles upon which every invention is made.

Prove it. Here is shown a very simple problem in invention. See how easily and quickly you can solve it. What would you put on shaft "A" to force members "B B" to move back? Think of something you know now which can give you the answer. If you have an ordinary electric light switch you will find it in a few minutes.

This proves that invention is not guesswork or blind luck—that it is not a God-given faculty possessed by a few favored mortals. The truth is that invention is based upon exact laws which anybody can learn. It is merely a matter of first *seeing* a problem to be fixed and then of *thinking* of something which solves the problem. Thats all. The problem shown here proves that when you think inventively, invention becomes as easy to learn as reading or writing.

Why More Inventions are Needed Now

Hundreds of years ago, the world didn't need many new things. That is why few inventions were made. But now the world has more needs, more things to be "fixed." And that is why, in the United States alone, over 50,000 inventions are patented every year!

The world wants better and cheaper light and power. It wants an electric light that will be heatless. It wants new motors that will weigh less and produce more power. It wants faster and less costly aeroplanes, motor cars, steam engines. It wants new inventions which will make cooking and housework easier. It wants new inventions that will save time and labor in the home, the farm, the factory and the office. It wants new ideas for toys and other amusements. It wants its present inventions to be developed so that they will work better and more economically.

Surely you have at least one idea which can be harnessed to a natural law for the solution of some problem. It can be a new kind of mechanical toy or some device which will make your wife's housework easier. It can even be something as simple as the common nutcracker. The man who invented the Kiddie-Kar, it is reported, made over $5,000,000!

But whatever your invention may be, if it fills a real need the world will pay you well for it. Every day you see things which can be improved or "fixed". Every day you can get ideas for new inventions. You have the ability to invent—NOW! All you need is the training to develop your ideas methodically, to think inventively.

What Edison Says

Could you ask the advice of any greater authority than Thomas A. Edison? Listen to what he says: "INVENTION IS A SCIENCE AND SHOULD BE TAUGHT AS A PROFESSION."

And now, for the first time, you can profit by Edison's advice. You can actually learn invention as a profession—exactly as other people are learning electricity, automobile mechanics, law, medicine, as a profession. Never before were the easy-to-learn principles of Inventive Science written down so everybody could read them, and learn to use them. But now the Bureau of Inventive Science offers you the first course in practical invention ever devised.

Learn Invention by Actual Practice at Home

Hitherto every inventor had to work out the principles of invention for himself. But at what a terrific price in long years of discouragement, lost time, wasted money! Now you can quickly learn the secrets of invention which brought wealth and fame to Edison, Marconi and other great inventors, in your spare time at home.

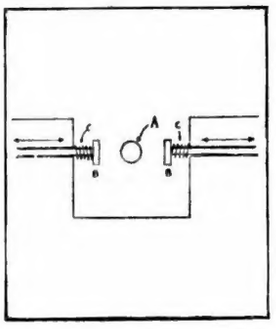
Fifteen famous inventors tell you WHAT TO INVENT and HOW TO INVENT. They tell you the secrets of invention which every successful inventor must know. They explain how to originate ideas, how to develop and perfect them, how to patent your inventions. But this course tells you more than how to invent. Thousands of inexperienced inventors have been defrauded out of their rewards because they did not know how to protect their patent rights, or how to sell their inventions. This great course tells you everything you want to know—how to sell your invention, how to get royalties, how to organize a company, how to get the most money for your ideas.

As Fascinating as a Game

The most fascinating part of this great new course is that it teaches you by actual practice, right in your own home. With each lesson you are sent some problem in invention—just like the one you worked out here.

This fascinating exercise in solving actual problems sharpens your instinct to fix things. Better than anything else, it gives you an unforgettable, instinctive habit of thinking inventively which is worth more than you realize. In fact, the lessons and exercises are so simple, so easy to understand, so interesting, that they seem more like a pleasant game than like instruction which can make you a successful inventor.

This test shows how easily you can develop your ability to invent



Here is an interesting little problem and its solution will be found very simple, if **we really think hard.**

"A" is the end of a shaft. The two members "B B" are free to move in either direction indicated by the arrows. If they are pushed back, the springs "C C" will immediately pull them forward again. Our problem is to put some kind of an attachment on the revolving shaft "A" so that the members "B B" will be pushed back both at the same instant every time the shaft "A" makes a single revolution. The device on shaft "A" must also allow the two members "B B" to come forward once in every revolution. What would you suggest putting on the shaft "A"?

Everything Explained in New FREE Book

A wonderful new book, just printed, tells you more about the Bureau of Inventive Science and its simple new course in invention. It explains in detail just how this course develops your ability to invent. It tells you how great inventors work, how little ideas have made fortunes, how you, too, can learn the secrets of invention, in your spare time at home.

Send today for this fascinating book and find out how to develop your ideas, how to get a patent, how to protect your invention, the best way to sell your invention, how to convert a simple little idea into big money. It costs you nothing, so if you are genuinely interested send the coupon at once. This Bureau is not connected with patent attorneys or manufacturers. Its only purpose is to teach you the secrets of successful invention. Write for the FREE BOOK now.

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BUILD YOUR SET BETTER -- AT LOWER COST

BUILD YOUR SET WITH BARAWIK STANDARD RADIO GOODS

EXCEL 180° VARIOCOUPLER

B522 .....$1.79

Properly designed and well made. Green silk windings over natural uncolored genuine bakelite tubes. Primary has taps every 7 turns and last 6 turns tapped every turn. Cast aluminum support with panel mounting screw. ¼ inch shaft. Produces best results in any type circuit for 175 to 625 meters.

SUPER 180° VARIOCOUPLER

B521 Each 98c

A wonderful value, produces excellent results. Green silk windings on black fibre tubes. Rigid mounting support for table or panel mounting. Primary tapped for fine tuning. ⅛ inch shaft. Suitable for any type circuit 200 to 600 meters.

B522 Variometer—same style. Each.....98c

SUPERIOR VARIOCOUPLER

B523 Each $3.15

A handsome instrument of superior design and construction. Stator tube and rotor ball of moulded red brown bakelite. Large size green silk windings insure highest efficiency. Table or panel mounting. ¼ inch shaft. Superior results in circuits for 180 to 650 meters. Tapped primary for finest tuning. Noiseless contacts.

B526 Special single circuit type.....$3.60

SUPER MOULDED VARIOMETER

B412 Each $2.60

Polished black moulded rotor and stator forms. Maximum inductances with greatest efficiency and minimum distributed capacity. A high grade durable instrument that will make up into a set that will get the best results. Wave length 180 to 600 meters.

EXCEL MOULDED VARIOMETER

B524 Each $3.68

A wonderful value at our price. Properly designed and constructed. Polished black bakelite rotor and stator forms. Large size. Green silk wire insures greatest efficiency. ¼ inch shaft. Noiseless pigtail connection. Table or panel mounting.

SUPERIOR VARIOMETER

B525 Each $4.45

Forms moulded of red brown bakelite. A neat handsome instrument. Green silk windings calculated for highest efficiency. ⅛ inch shaft. Noiseless pigtail connections. Table or panel mounting. Produces superior results in any type circuit 180 to 650 meters.

RADIO INDUCTANCE COILS

Carefully made—fine looking coils. Highest efficiency. Low distributed capacity effect, low resistance—high self inductance. Very firm impregnation. Range given is in meters when varied with .001 variable condenser. Mounted coils have standard plug mountings.

Turns	Range	Art No.	Not Mntd.	Art No.	Price Mntd.
25	120- 250	B301	$0.39	B320	$0.85
35	175- 450	B302	.42	B322	.95
50	240- 720	B303	.49	B323	1.02
75	390- 910	B304	.54	B324	1.08
100	500- 1450	B305	.58	B325	1.13
150	600- 2000	B306	.63	B326	1.17
200	900- 2500	B307	.72	B327	1.26
250	1200- 3500	B308	.78	B328	1.35
300	1500- 4500	B309	.82	B329	1.36
400	2000- 5000	B310	.97	B330	1.57
500	2800- 6100	B311	1.12	B331	1.63
600	4000-10000	B312	1.27	B332	1.78
750	5000-12000	B313	1.43	B333	1.93
1000	7900-15000	B314	1.70	B334	2.25
1250	9750-19500	B315	1.92	B335	2.45
1500	14500-26500	B316	2.18	B336	2.60

INDUCTANCE COIL MOUNTINGS

B340—3 Coil. Ea. $3.40
B341—2Coil. Ea. 2.75

Sturdy, rigid durable construction. Made of polished black bakelite.

COIL MOUNTING PLUGS

Made of moulded bakelite.

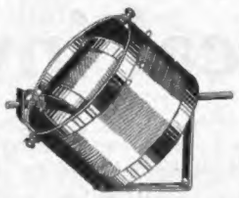
B344 Plug for mounting "honeycomb" inductance coils 48c
B345 Stationary plug to fasten mounted coil stationary to panel 89c
B346 Movable plug to fasten mounted coil to panel so it can be rotated $1.10

HIGH-GRADE LIGHTNING ARRESTER

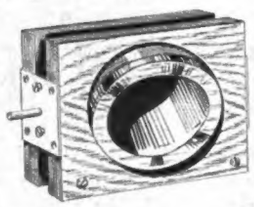
B981 Each 75c

A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected.

OUR SPECIAL VARIOMETER AND VARIOCOUPLER



Build into your set reliable instruments. You can depend on this variometer and variocoupler to give you the best results in any circuit working from 180 to 650 meters. In design and construction they are the best. Only the highest grade materials are used. The prices quoted save you 30 to 40 percent. Why pay more?



B418 Variocoupler. Each.....$2.45

The most efficient type of coupler, insures better tuning and louder signals. Primary and secondary wound on natural uncolored genuine bakelite tubes. Handsome green silk windings. Primary tapped for fine tuning. Can be panel or table mounted. ⅛ inch shaft.

B410 Variometer. Each.....$2.10

Perfect in design and construction. Accurate wood forms thoroughly seasoned. Correct inductive ratios. Solid baked windings. Plenty of large sized wire insures highest efficiency. A strong high grade instrument that will give you lasting service. ¼ inch shaft.

MAGNET WIRE

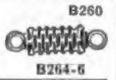
Insulated copper wire. Best quality even drawn wire, one piece to a spool. Prices quoted are for 8 oz. spools unless otherwise stated.

Double Cotton Covered		Enameled Insulation		Double Green Silk Covered	
Number B990		Number B992		Number B991	
Gauge	Price	Gauge	Price	Gauge	Price
18	.43c	20	.39c	20	$0.78
20	.55c	22	.50c	22	.95
22	.70c	24	.55c	24	1.10
24	.80c	26	.60c	26	1.38
26	.90c	30	.65c	30 (4 oz).	1.25
28	$1.05	32	.70c	32 (4 oz).	1.65
30	1.45	36	.90c	36 (4 oz).	2.20

ANTENNA INSULATORS

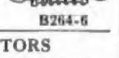
B260 Size 1x3¼. Two for 17c

B234 Size 1½x4. Two for 69c



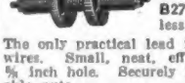
B260

B266 Size 1½x10½. Two for $1.28



B264-6

LEAD-IN INSULATORS



B270 For 4 inch walls or less 42c
B271 For 9 inch walls or less 69c

The only practical lead in insulator for aerial wires. Small, neat, effective, durable. Fits ⅝ inch hole. Securely locked by two adjustable nuts.

OUTDOOR LIGHTNING ARRESTER

B980 Price $1.55

Protect your instruments with this lightning arrester. You cannot afford not to. Weatherproof porcelain case. Air gap type. Permanent. Durable. The most practical quality arrester obtainable. Underwriters approved.

SPIDER WEB COILS

B290— 25 turn. Each.....35c
B291— 35 turn. Each.....37c
B292— 50 turn. Each.....43c
B293— 75 turn. Each.....48c
B294—100 turn. Each.....52c

A new popular type of inductance of highest efficiency. Lowest distributed capacity and high frequency resistance. Firm green silk windings with fibre mounting strips.

REINARTZ INDUCTANCE

B296 Each $1.10

Made of green silk covered wire, spiderweb wound to produce greatest efficiency and lowest losses. 21 taps so arranged that crossing is avoided. Two fibre strips and wooden rod furnished permit various styles of mounting. With this coil a high grade set can be built at a low cost. Directions included.

ULTRA AUDION COIL

B296 Each 78c

Spider web wound of green silk covered wire. Four taps. Produces wonderful results. Fibre strips and wooden rod for mounting included. Directions furnished.

SOLID BARE COPPER WIRE

Solid bare copper wire for aerials, leads or wiring instruments.

Solid Bare Copper Wire, size 14.
B240—100 ft. coil 40c **B242**—500 ft. coil $1.95

Solid Bare Copper Wire, size 12.
B244—100 ft. coil 67c **B245**—500 ft. coil $3.05

BRASS ROD

Supplied only in 8 inch lengths.

B961 Threaded 6-32, per 8 inch length... 6c
B963 Threaded 8-32, per 8 inch length... 8c
B965 Solid 3-16 inch, per 8 inch length... 6c
B967 Solid ¼ inch, per 8 inch length... 9c

SPAGHETTI

For covering connecting wires in sets. For size 12 and 14 wires.

B955 Finest quality braided and saturated with best baked lustrous transparent insulating varnish, 3 feet for 19c
B956 Best quality braid and covered with black insulating compound. 3 feet for..... 9c

TINNED COPPER "BUS BAR" WIRE

Size 14 tinned copper wire. For wiring sets. Best size for neat job and easy soldering.

B969 Round. Ten feet for.....12c
B970 Square. Ten feet for.....14c

RADIO SOLDERING IRON

B540 Each $1.50

Soldered connections in radio sets produce better results. This guaranteed iron is exactly right for radio work. A neat solid connection quickly and easily made. Operates on any lighting current 100 to 120 volts. 6 ft. cord with attaching plug. Length 13 inches. Heats quickly will not overheat.

Heavier irons for general repair work. Wonderful values at our prices.

B541 Medium size $3.48
B542 Larger size. 4.25

TINOL

B969 Per tube 19c

A combined solder and flux in handy form. Put a little on the connection heat with a match, torch or solder iron and you have a neat electrically and mechanically perfect joint.

AUTOMATIC BLOW TORCH

B543 Each $1.19

Burns denatured alcohol. Automatically generates pointed flame in a few seconds. Easy to solder joints in hard places. Lights with a match. Burns 20 minutes on one filling. 5½ inches high, ⅞ inch cylinders. Works fine with Tinol listed above.

SUPER BLOW TORCH

B544 Each 39c

Burns denatured alcohol. Vest pocket size. Blowing on tube produces a hot pointed flame. Lights with a match. Works fast. Burns 10 minutes on one filling. Easy to solder joints in hard places. 3 inches high. ⅞ inch cylinder. Long rubber tube. Produces fine joints with Tinol listed above.

PANEL MOUNTING VARIABLE CONDENSERS

These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even, reliable capacity. Our low prices save you money. These condensers are of the very best make and are not to be compared with many inferior, cheap condensers offered. We guarantee them to please you or your money back. The vernier style has one separately controlled plate which permits of the finest tuning.

REGULAR STYLE

B815—3 plate 79c
B816—5 plate 97c
B814—11 plate .00025 mfd. $1.32
B813—21 plate .0005 mfd. 1.43
B812—43 plate .001 mfd. 1.73

VERNIER STYLE
Including Dial and Knobs

B825—14 plate .00025 mfd. $2.45
B824—26 plate .0005 mfd. 2.85
B826—16 plate .001 mfd. 3.15

STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.
B248—100 ft coil 58c **B249**—500 ft. coil $2.75

OUR SPECIAL AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

B550 Each $2.25

The result of years of research work and experienced engineering. In quality of tone and volume of sound, the things a transformer is built for, we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. 5 to 1 Ratio. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect. Not to be compared with articles built for price only.

OUR SPECIAL SHIELDED TRANSFORMER

B551—3½ to 1 Ratio.
Each $2.75
B552—6 to 1 Ratio.
Each $2.75

The same high grade style of transformer as above, enclosed in a metal case which completely shields it from any outside magnetic influences. Very attractive appearance and sturdy construction. Free from howling and local disturbances.

THORDARSON AUDIO FREQUENCY AMPLIFYING TRANSFORMERS.

B232 Ratio 3½ to 1.
Each $3.40
B233 Ratio 6 to 1.
Each $3.80

Recognized by leading radio engineers as the best balanced and most efficient transformer. Correct characteristics for any standard tube. Wonderful results without distortion on one, two or three steps. Plainly marked binding post connections on bakelite panel.

OTHER STANDARD BRANDS AUDIO FREQUENCY TRANSFORMERS

Fresh, clean stock in original containers.

B553 Acme. Each $4.45
B554 Coto. Each 4.45
B555 Federal. Each 4.45
B712 Radio Corp. Each..... 6.40

RADIO FREQUENCY AMPLIFYING TRANSFORMER

B560 For 201A or 301A Tubes, ...$1.70
B561 For 199 or 11 or 12 Tubes 1.70

Due to its special design this transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. While low in price we believe it equal or superior to higher priced transformers. Perfect for one, two or three stages. Compact, convenient form, easily mounted. Range 175 to 600 meters. Try it. If you are not satisfied return it and get your money back.

OTHER STANDARD BRANDS RADIO FREQUENCY TRANSFORMERS

B562 Dubilier. Each $4.45
B563 Coto. Each 4.45
B564 Rasla. Each 4.45
B565 Acme. First stage. Each..... 4.45
B566 Acme. Second stage. Each..... 4.45
B567 Acme. Third stage. Each 4.45
B714 Radio Corp. Each 5.95
B995 All American. Each 3.75

LONG NOSE PLIERS

B970 Price 95c

The handiest pliers for radio work. Made of fine hardened steel. Length, 5 inches.

DIAGONAL JAW NIPPERS

B972 Price $1.05

For fine electrical work, made of hardened steel. length 5 inches.

FOUR-IN-ONE SCREW-DRIVER

B974 Each 55c

Especially suitable for radio work. Will handle any size screw used. Smaller drivers nest inside larger one and are held in place with screw cap. Made of steel, nickel finished.

NEUTRODYNE TRANSFORMERS

B571 Per set of three.....$4.95

An air core transformer for use in neutrodyne method of reception. Can also be used for tuned radio frequency or as a fixed coupler with condenser across secondary. Proper design for results and efficiency. Green silk windings on bakelite tubes with adjustable mounting brackets to fit most any condenser.

NEUTRALIZING CONDENSERS

B572 Per set of two.....40c

Simple, inexpensive, effective precision type. Micrometer adjustment is attainable. Easily mounted in circuit.

ENCLOSED VARIABLE CONDENSERS

One of the best made condensers. Rigid, accurately spaced aluminum plates. Fortransparent case. Knob and pointer. Clear transparent case.
B806 43 plate .001 Mfd.$2.80
B808 21 plate .0005 Mfd. 2.45

THE BARAWIK CO. Chicago's Original Radio Supply House Beware of Imitators 102 South Canal Street CHICAGO, ILL.

WITH BARAWIK STANDARD RADIO GOODS

WE PAY TRANSPORTATION CHARGES EAST OF THE ROCKIES

PRESERVE THESE PAGES—ORDER FROM THEM AND SAVE MONEY
FAST SERVICE—TRY US AND BE CONVINCED

THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR

OUR GUARANTEE PROTECTS YOU—We handle only the best goods carefully tested and checked by expert radio engineers. You are assured of getting guaranteed apparatus that will give superior results. And while ou goods are best, our prices are lowest. Our goods equal or surpass the claims we make for them. We do not attempt to deceive or mislead. Our reputation for fair dealing is our most valued asset.

HOW TO ORDER—Write your Order plainly, state Article Number, Description and Price of items wanted. Send Postoffice or Express Money Order, Certified Check or Bank Draft for Total of Order. Prompt Shipment is assured when these directions are followed.

VACUUM TUBES

Standard Brands—Cunningham Radiotron. Every one guaranteed new and perfect. We will ship brand in stock unless you specify otherwise.

B105 Detector, UV200 C300 Ea. $4.30
B112 Amplifier, UV201A C301A 5.95
B118 5 Watt Transmitter 7.70
B107 WD11 C11. Each..... 5.95
B101 WD12 C12. Each 5.95
B102 UV199 C299. Each..... 5.95
B104 UV199 Adapter fits 199 tube to standard socket 42c
B108 WD11 Socket. Each..... 35c
B109 WD11 Adapter. Each..... 48c

STANDARD TUBE SOCKET

B140 Each 39c

Moulded of genuine red brown bakelite. Binding post connections. For table or panel mounting. Neat and strong.

METAL TUBE SOCKET

B146 Each 42c

A strong durable socket for panel or table mounting. Metal tube and base. Plainly marked binding post connections well insulated.

TWO AND THREE GANG SOCKETS

These sockets make it easy to build detector and amplifier units and make a neat, compact workmanlike job. Perfectly made of high grade materials. Quickly mounted on panel or base.

B147 Two-gang socket 95c
B149 Three-gang socket 1.30

199 SOCKET

B145 Each 49c

Moulded of high insulating material. Sponge rubber base prevents ringing in tube. Plainly marked binding post connections. Neat and compact.

FILAMENT CONTROL RHEOSTATS

B132 6 ohm. Each.....45c
B129 20 ohm. Each.....52c
B131 30 ohm. Each.....59c
B135 6 ohm Vernier 95c

Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2¼ in. Tapered polished black knob 1¼ in. diam.

POTENTIOMETERS. Match above rheostats. Same high grade construction.

B151 200 ohm 79c
B152 400 ohm 79c

SUPERIOR RHEOSTATS

B153— 6 ohm. Each.....69c
B154—20 ohm. Each.....76c
B155—30 ohm. Each.....83c

The finest rheostat. Smooth, even action. Best design, best workmanship. Supplied with attractive dial and knob. A rheostat for high grade sets.

POTENTIOMETERS to match above rheostats, with dial and knob.

B156—375 ohm 98c

QUICK ACTING VERNIER RHEOSTAT

B124— 6 ohm 79c
B125—15 ohm 88c
B126—30 ohm 99c

Vernier adjustment at every degree of resistance. Pushing knob in turns off the filament.

THREE INCH DIAL

B923 For 3-16 inch shaft. Each 19c
B924 For ¼ inch shaft. Each 19c

A handsome neat looking dial moulded in one piece of polished black composition. 180° scale marked 0 to 100 finely engraved in contrasting white enamel. Diameter 3 inches.

TWO INCH DIAL

B921 For 3-16 inch shaft. Each 16c
B922 For ¼ inch shaft. Each 16c

A handsome dial moulded in one piece of polished black composition. 270° scale marked 0 to 100 finely engraved in contrasting white enamel. Fine for rheostat or switch control. Diameter 2 inches.

BAKELITE DIALS

B931—2 in. Diam. for 3-16 inch shaft. Each.....32c
B932—2 in. Diam. for ¼ inch shaft. Each 32c
B933—3 in. Diam. for 3-16 inch shaft. Each.....33c
B934—3 in. Diam. for ¼ inch shaft. Each.....33c
B935—4 in. Diam. for ¼ inch shaft. Each.....40c

Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Sizes match perfectly.

COMPETITOR JACKS

B387 Open circuit. Each.....27c
B388 Two circuit. Each.....35c

Well made, durable smooth working, nickel finished frame. Well insulated.

VERNIER DIAL ADJUSTER

B941 Each 19c

Easily installed at edge of dial, gives finest vernier adjustment of condenser or inductance. A great value. Polished black knob.

ENCLOSED DETECTOR

One of the finest crystal detectors on the market. supersensitive galena crystal enclosed in heavy glass shield. Quick, positive adjustment. Brass parts polished nickel finish.

B730 Each 89c

GALENA DETECTOR

Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish. An unequaled value.

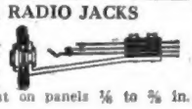
B732 Each 59c

DETECTOR PARTS

B725 Price set...23c

All metal parts for crystal detector. No base included. Easily assembled. Polished nickel finish.

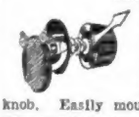
SUPERIOR RADIO JACKS



Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in. thick.

B390 Open circuit. Each.....38c
B391 Closed circuit. Each.....46c
B392 Two circuit. Each.....55c
B393 Single circuit filament cont.....59c
B394 Two circuit filament cont. 76c

SUPERIOR VARIABLE GRID RESISTANCE



B167 Each 80c
B168 With .00025 Condenser 95c

Eliminates hissing, clarifies signals. Capacity smoothly varied from 0 to 6 megohms by half turn of knob. Easily mounted on any panel.

TUBULAR GRID LEAKS AND CONDENSERS

Very convenient. Permit of quick change of leaks or condensers of varying capacity. Cut shows leak mounted. Leaks and condensers have same appearance. Each part priced separately.

B849 Grid Leaks. Each.....18c

RESISTANCES—½, 1, 1½, 2, 3, 5, 7 and 10 megohms. Specify which size is wanted.

B831 Grid and Plate Condensers. Each...39c

Capacities—.00025, .0001 .00025, .0005 mfd. Specify which size is wanted.

MOUNTINGS
Bakelite base. Spring clip contacts.
B840 Single mounting. Each.....29c
B842 Double mounting. Each.....49c
B844 Triple mounting. Each.....69c

HYDROMETER

B190 Each 48c

Accurately tells you the condition of your storage battery. Helps you keep your battery in better condition.

SWITCH LEVERS

Very neat polished black composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing, spring and two set nuts. A high grade switch.

B381 1¼ in. Radius. Each 15c

SWITCH LEVER STOP

Brass polished nickel finish.

B386—Dozen 18c Hundred $1.05

CABINETS

Fine looking cabinets solidly built. Elegant hand rubbed finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Front rabbeted to take panels. Panels not included. Prices are transportation paid.

Panel Size	Inside Dimensions High	Wide	Deep	Art. No.	Price Each
6x 7"	5⅛"	6⅛"	7"	B420	$2.35
6x10½"	5⅛"	10"	7"	B422	2.75
7x14"	6⅛"	13⅛"	7"	B423	3.35
7x18"	6⅛"	17⅛"	7"	B426	3.75
7x21"	6⅛"	20⅛"	7"	B425	3.85
7x24"	6⅛"	23⅛"	7"	B429	4.65
9x14"	8⅛"	13⅛"	10"	B428	3.55
12x14"	11⅛"	13⅛"	10"	B430	4.65
12x21"	11⅛"	20½"	10"	B432	5.45

RADIO "BAKELITE" PANELS

Notice our very low prices on this fine quality material. We supply genuine Bakelite, Condensite Celeron or Formica, all of which are materials with practically identical mechanical, chemical and electrical properties. Machines well without chipping. Won't warp. Waterproof. Highest mechanical and dielectric strength. Attractive natural polished black finish which can be sanded and oiled.

Panel Size Inches	⅛" thick Art. No.	Price	3-16" thick Art. No.	Price	¼" thick Art. No.	Price
6x7	B450	$0.50	B460	$0.75	B470	$0.98
6x10½	B451	.75	B461	1.11	B470	1.47
7x14	B458	1.20	B468	1.80	B478	2.40
7x18	B453	1.55	B463	2.30	B473	3.10
7x21	B457	1.78	B467	2.65	B477	3.60
7x24	B459	2.10	B469	3.10		
9x14	B454	1.60	B464	2.30	B474	3.10
12x14	B455	2.10	B465	3.10	B475	4.15
12x21	B456	3.15	B466	4.65	B476	6.20

INDUCTANCE SWI

B385 Price including knob and dial $1.29

Mounts switch points and contact lever behind panel. Only one hole needed to mount. 15 switch points, any number of which may be used. Smooth wiping contacts. Attractive tapered knob.

SUPERIOR INDUCTANCE SWITCH

B386 Each 79c

Quickly and securely mounted by drilling one hole. Only knob and pointer show in front of panel. Connections can be soldered before fastening switch, making assembly much easier. Metal parts nickeled. Bakelite knob and supporting base.

BARAWIK QUALITY HEADSETS

B770 Per Set, 2000 ohms.....$3.25

These headsets have proven on rigid tests to be one of the very best on the market. The tone quality is excellent with an unusual volume. Skilled workmen make them from only the best selected materials. The receiver cases are fine polished finish with polished black ear pieces. Fabric covered head band comfortably and quickly fitted to the head. Supplied with 5-foot cord. These sets were designed to sell for much higher prices than we ask, and at our price are a wonderful bargain. We guarantee that you will be pleased with them and agree that they are the best value by far yet offered. If they don't suit you we will cheerfully return your money.

STANDARD BRAND HEADSETS

B754 Baldwin Type C with universal jack plug.....$11.75
B756 Red-head, 3000 ohm 5.78
B768 Brandes, 2000 ohm 5.35
B769 Brandes, 3000 ohm 6.95
B751 Murdock 56, 2000 ohm 4.20
B752 Murdock 56, 3000 ohm 4.95
B764 Frost, 2000 ohm.. 4.20
B766 Frost, 3000 ohm.. 4.85
B758 Western Electric .. 9.50

PLATE CIRCUIT "B" BATTERIES

You can make real savings on these batteries. Don't pay more. We guarantee them to equal any on the market regardless of price. Absolutely uniform. Extra long life.

B180 Signal Corps type, small size. 15 cells, 22½ volts. Each...$1.05

B184 Variable Large Navy size, 6½x4x3 inches 5 taps, giving range from 16½ to 22½ volts in 1½ volt steps. Each.....$1.95

B188 Combination Tapped 45 volt, 30 cell, 13x4x3 battery. Tapped to give 45, 22½, 21, 19½, 18 and 16½ volts. Handles both detector and amplifier tubes. Each.....$3.75

"B" BATTERY METER

B189 Each 98c

Reads 0 to 50 volts. Accurately tells you the exact condition of your B Battery. Convenient watch size. Polished nickel case with wire lead.

STORAGE "A" BATTERY

A very high grade battery made especially for radio service. Guaranteed for three years. Properly cared for will give many more years of service for filament lighting. Made of best new materials. Full capacity. The best battery buy on the market. Try one of these batteries on your set for 10 days. If at the end of that time you are not fully satisfied with the battery return it and we will refund the purchase price.

B194 6 volt, 40 ampere size. Each.....$10.75
B196 6 volt, 80 ampere size. Each.... 13.25

HOMECHARGER BATTERY CHARGING RECTIFIER

Charge your battery at home over night for a few cents. Simply connect to any 110 volt 60 cycle light socket, turn on current and rectifier does the rest automatically. Will work for years without attention. Simple connections. Gives a tapering charge which batteries should have. You can make it pay a profit charging your friends' auto batteries. Long connecting cords with pair of battery clips.

Prices are Transportation Paid.

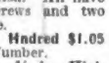
B201 For 6 volt battery $12.95
B203 For 12 volt battery..... 12.95

BATTERY CLIPS

B198 Two for 28c

Clip onto storage battery terminals, lead coated. Make positive non-corrosive contact at all times.

WIRE CONNECTING CLIPS



B199 Per dozen 30c

Small connecting clips for quickly fastening leads onto binding posts, etc. Handy and useful. Every radioist should have at least a dozen.

SWITCH CONTACT POINTS

Brass polished nickel finish. All have ⅝ in. long size 6-32 screws and two nuts. All prices the same.

Dozen 18c Hndred $1.05

Order by Article Number.

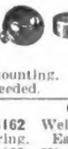
B360 Head, ¼ in.; Diam. ¼ in. High
B362 Head, 3-16 in.; Diam. ⅜ in. High
B363 Head, 3-16 in.; Diam. 1-16 in. High

Solder Lugs to Fit Contact Points

Also for connecting wires to binding posts, etc.

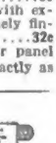
B365 Dozen 8c Hundred 30c

BINDING POSTS

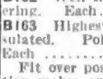


Brass, polished nickel finish. Washer and 6-32 in. screw extending ⅝ in.

B370 Large size — barrel and knob ⅜ in. long, dozen 85c
B372 Smaller size — barrel and knob 9-16 in. long, dozen 70c



VARIABLE GRID LEAKS



B160 Standard style 16c
B161 De Luxe style with extra heavy screw top finely finished 32c

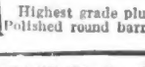
Pencil mark type for panel mounting. Resistance may be varied exactly as needed.

GRID CONDENSERS

B162 Well Insulated. Paper covering. Each.....8c
B163 Highest grade. Mica insulated. Polished nickel case. Each 23c

Fit over posts of above leaks. The combination makes an efficient unit. Cap. .00025 mfd.

SUPERIOR RADIO PLUGS



B395 With set screws for fastening cord. Each 35c
B397 Two-way — takes two pair any style cords Each 59c

Highest grade plugs. Fit any standard jacks. Polished round barrels.

BUILD YOUR SET WITH BARAWIK STANDARD RADIO GOODS

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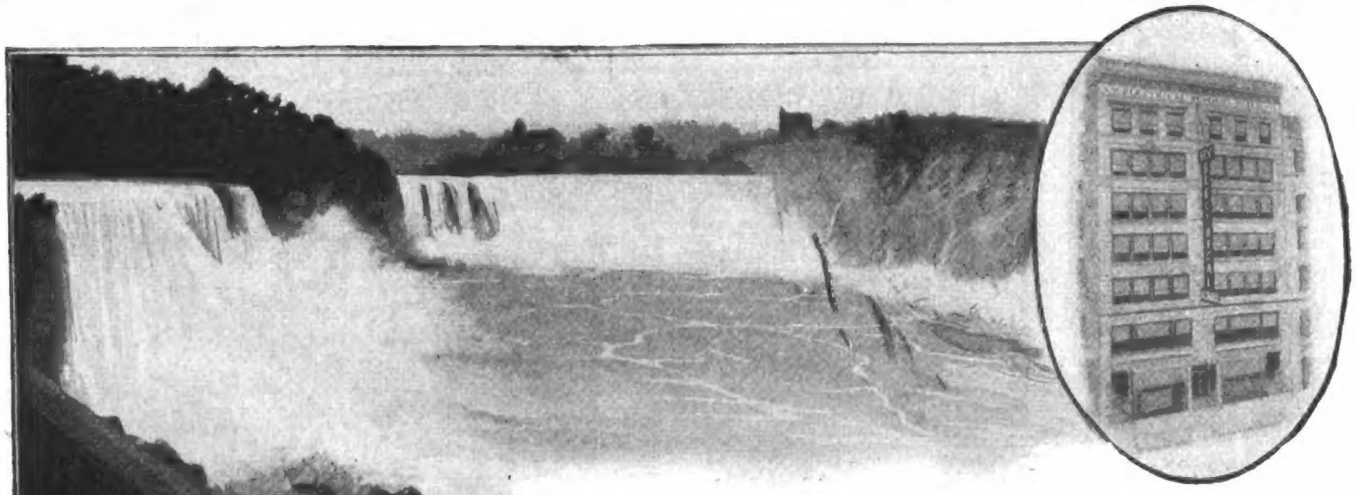

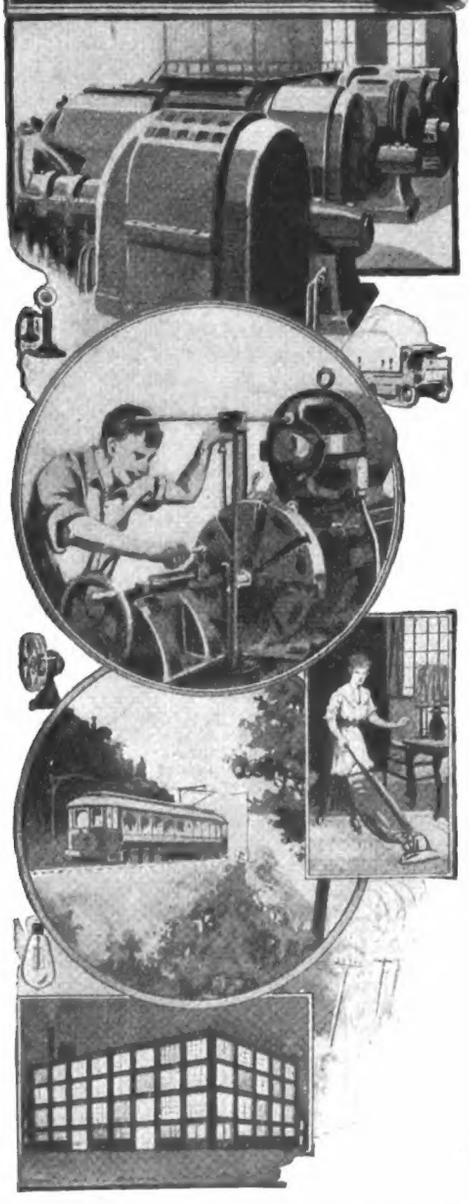

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Volume XI
Whole No. 126

Science and Invention

OCTOBER
1923
No. 6

H. GERNSBACK, EDITOR AND PUBLISHER
H. WINFIELD SECOR, ASSOCIATE EDITOR
T. O'CONOR SLOANE, Ph.D., ASSOCIATE EDITOR
Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact"--HUXLEY

The "New" Science and Invention

By H. GERNSBACK

THIS issue of SCIENCE AND INVENTION witnesses an important and far reaching innovation, not only in the magazine field, but in the technical press as well. For some time we have felt that SCIENCE AND INVENTION was not fulfilling its mission as it should. When this magazine was first established in 1913, as the ELECTRICAL EXPERIMENTER, it was a highly technical magazine and its circulation reached a figure of not more than 100,000. The reason for this was that there are only a limited number of technical-scientific readers in the country who can support such a magazine. Consequently in 1920 the magazine broadened its scope and changed its name to SCIENCE AND INVENTION. Sometime previous to the change of name, the magazine had not been strictly electrical nor strictly experimental. It had been found necessary to embrace other scientific lines in order to satisfy the demands of its readers. Then when the magazine became known as SCIENCE AND INVENTION, the circulation quickly jumped up close to 200,000 copies in 1921. The reason, of course, was that more readers were interested in the sort of matter we published at that time and the material we have been publishing ever since.

But recently we have been aware that we could give our readers more for their money. Along the old and established line of publishing, we printed illustrations and lengthy articles. Often it was necessary to reduce illustrations to such an extent that they did not show up very well. This was necessitated by the fact that we had to run so much text.

A diligent canvas among many readers of SCIENCE AND INVENTION tended to show that few people actually read the articles. Most of them studied the illustrations and read the captions. We point with pride to our illustrations and particularly to the technical ones. We have been fortunate to secure artists who know how to illustrate difficult subjects in such a way that words really become superfluous.

Moreover, in these days, people do not wish to read if they can help it. A picture or illustration correctly made can tell a story more eloquently than 5,000 words. That is one of the reasons why motion pictures have been so eminently successful; pictures, a few titles, and the story is told far better than any book could do it.

Bearing these things in mind, we have come to the conclusion that the world really needs an entirely new sort of magazine. The answer is simple. *Nothing but pictures, with captions, to explain the story.* The result is the new SCIENCE AND INVENTION now in your hands. The editorial policy remains exactly the same as before. No changes have been made as you will notice. *Instead, we are offering three to four times as much material as we have ever offered before.* All of our departments, as you will note, have been reduced to pictures and captions, with the exception of our scientific fiction stories which for the time being will run on as usual. The reason is that the average man or woman does not wish to laboriously wander through miles of text of scientific facts, which means concentration and study. With fiction, however, this does not hold true because fiction is an entertainment; it does not require study. On the other hand, *we have tried to reduce all scientific matter to entertainment instead of study.* As to how successful we will be in this issue and subsequent ones, you are the sole judge. At any rate, we believe there is a very large public interested in scientific matters and if such matter can be presented in an easily digestible form, it will, we hope, be welcomed by the multitude.

If we make it possible for the man in the street to absorb scientific knowledge without headaches and without trepidation, we believe we shall have accomplished a distinct service to humanity. To the average man, Science means a musty book, sealed with 7 seals The average man will have none of it. If on the other hand we can show your mother, your wife, or your children that Science is a most interesting subject of which every one in all walks of life should know more, then we believe we shall have achieved our goal.

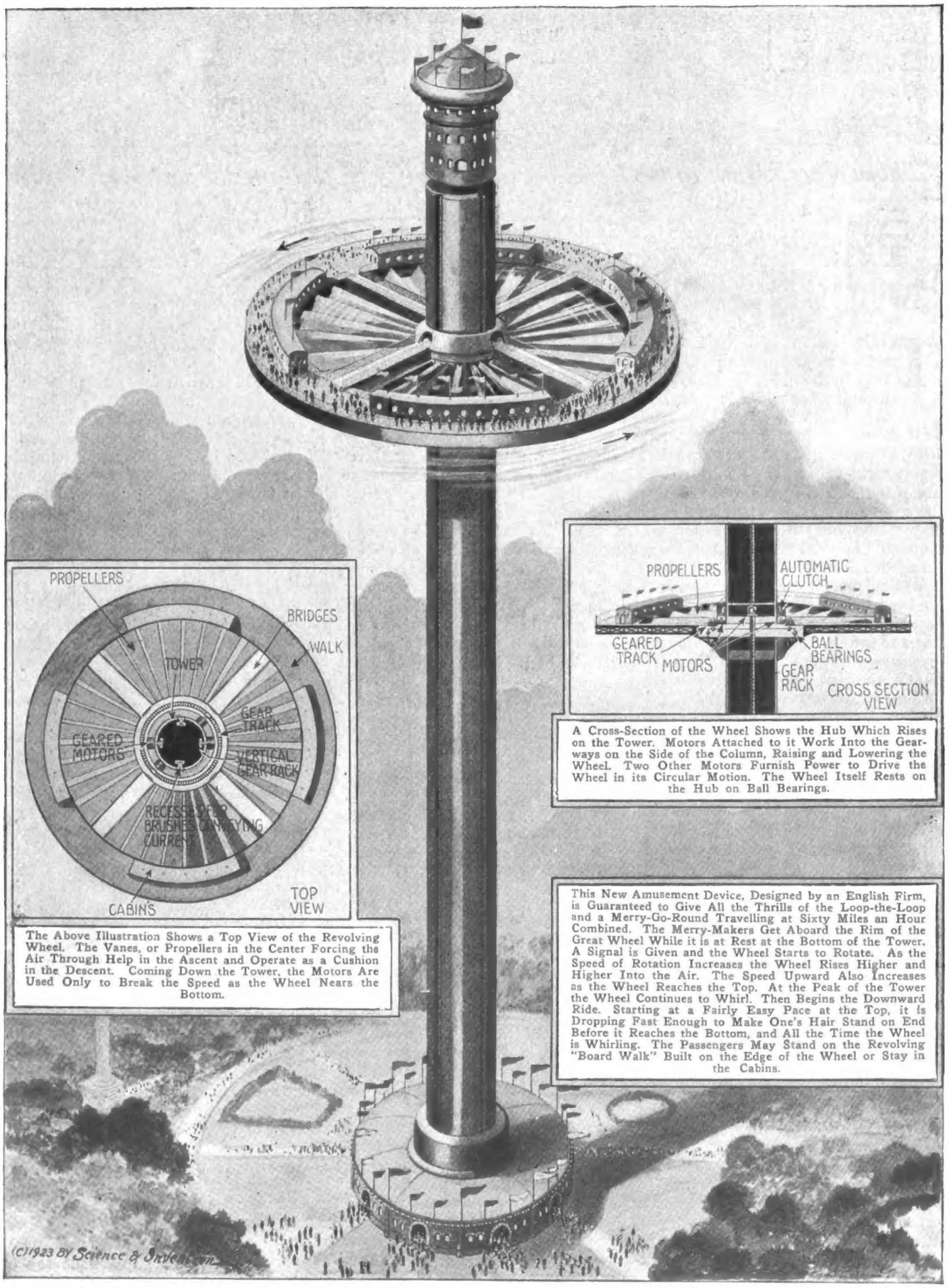
Science in all its phases, is the most wonderful thing that the world has ever known and it is just beginning to come into its own. Not so very many years ago, men were burned at stakes and murdered for inventing or thinking up something new. Today the scientist is glorified. Science touches every one of us in one way or another, and is regulating and running our very lives. Science and invention are the direct causes of our huge fortunes, our great industries and the greater part of our national wealth. It will be our purpose to disseminate such scientific knowledge, not only in a palatable manner, but in a way that "he who runs may read."

In conclusion, may we ask a personal favor of you? Please write and tell us frankly how this first issue of the new SCIENCE AND INVENTION strikes you.

THE GOLDEN AGE OF SCIENCE

is now symbolized by the golden cover of SCIENCE & INVENTION. Beginning with this issue, SCIENCE & INVENTION will have a golden cover every month. LOOK FOR THE GOLD COVER!

A Whirl of Merriment



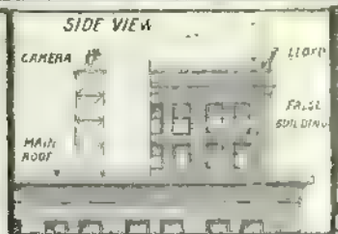
The Above Illustration Shows a Top View of the Revolving Wheel. The Vanes, or Propellers in the Center Forcing the Air Through Help in the Ascent and Operate as a Cushion in the Descent. Coming Down the Tower, the Motors Are Used Only to Break the Speed as the Wheel Nears the Bottom.

A Cross-Section of the Wheel Shows the Hub Which Rises on the Tower. Motors Attached to it Work Into the Gear-ways on the Side of the Column, Raising and Lowering the Wheel. Two Other Motors Furnish Power to Drive the Wheel in its Circular Motion. The Wheel Itself Rests on the Hub on Ball Bearings.

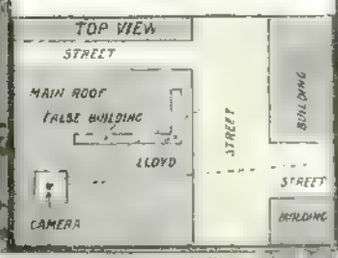
This New Amusement Device, Designed by an English Firm, is Guaranteed to Give All the Thrills of the Loop-the-Loop and a Merry-Go-Round Travelling at Sixty Miles an Hour Combined. The Merry-Makers Get Aboard the Rim of the Great Wheel While it is at Rest at the Bottom of the Tower. A Signal is Given and the Wheel Starts to Rotate. As the Speed of Rotation Increases the Wheel Rises Higher and Higher Into the Air. The Speed Upward Also Increases as the Wheel Reaches the Top. At the Peak of the Tower the Wheel Continues to Whirl. Then Begins the Downward Ride. Starting at a Fairly Easy Pace at the Top, it is Dropping Fast Enough to Make One's Hair Stand on End Before it Reaches the Bottom, and All the Time the Wheel is Whirling. The Passengers May Stand on the Revolving "Board Walk" Built on the Edge of the Wheel or Stay in the Cabins.

(C)1923 BY Science & Invention

How Trick Movie Sets Fool Us



Plan and Side View of the False Buildings, or Sets, Erected Atop Los Angeles Skyscrapers on Which Harold Lloyd Did His Hair Raising Stunts in "Safety Last." Since the Camera Takes Everything as Nearly a Flat Surface, the Film Thoroughly Deceived Onlookers. Harold Acted His Part in Perfect Safety Most of the Time. Three Different Buildings Had to Be Used in Order to Get the Correct Height Effect



The Above Excerpt from Harold Lloyd's Thriller, "Safety Last," Gave the Audience a Little Chill Because They Thought He Was Four Stories Up with Nothing But a Thin Finger Hold Between Himself and the Pavement. In Fact, He was Only Nine Feet Above the Roof of a Three-story Building

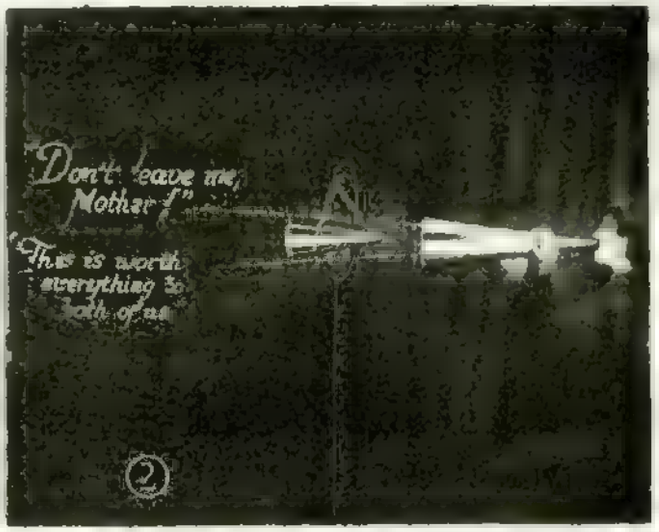
The Sketch (Right) Shows How the Producer Utilized the Fact That the Camera Tends to Take Everything as a Plane. The Camera's Field of Vision Was Set So That the Property "Set" and the Real Building Upon Which it Rested Ran Together and Gave the Audience a View of the Street Below.

Three Buildings Had to be Used in the Production to Gain the Height Illusion Properly. The Picture Below was Taken Atop a Seven Story Office Building

The Background Here is the Same as in the View Across the Page. Note How Cleverly the Location Was Selected so the False Building Would Line Up With the Other Buildings on the Street. The Sketch (Left) Shows How an Offset Corner Was Necessary

For the Last Part of the Thrilling Climb a Two-Story Replica Coping and Roof Were Erected on a Twelve Story Building. It Had to Be Set in Only Eight Feet from the Edge of the Supporting Building. But with a Fall of a Little Less Than 15 Feet Possible There Was Little Danger

Movies Expose



In the Motion Picture "The Satan's Paradise" a Complete Expose of Tricks Practised by Mediums is Given. This Picture Was Made in Accordance with the Dictates of a Detective from Scotland Yard, Who Was Active in the Investigation of Spirit Mediums in England

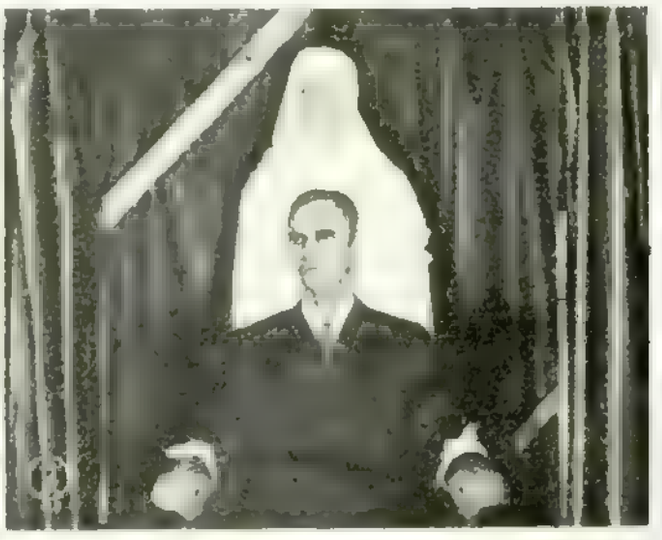
In Picture Shown Above the Medium is Outside of Her Dark Cabinet and is Just About to Suspend a Horn from the Stand Shown on the Table. The Anxious Mother is Expecting News from Her Son Reported Missing at the Front During the World War. In Her Quest for Knowledge Regarding Her Son, She Meets Many of the Imposters Who Are Caught in the Acts Illustrated Here. For Instance, a Message is Written Upon a Sheet of Paper and Placed Between Two Slates Which Are Bolted Together.

The Detective Shown at the Right in Picture No. 3 Discovers That the Slate Slides Out of its Holder, Permitting Access to the Message Without Necessity of Removing the Bolts, Which Hold the Two Frames Together. In the Photo Below the Method of Delivering a Message to a Medium in the Dark Cabinet is Shown. Note the Stick with the Message at the End Passing Beneath the Medium's Skirt.

In Photo 2 Shown Above, What Appears to be a Sound Coming from the Horn on the Stand is in Reality a Deception. The Medium Having Read the Message Delivered to Her, as Per Pictures 5 and 6, Answers by Talking Through the Megaphone Held by Her Within the Cabinet. This Horn is in Line with the Horn Outside of the Cabinet

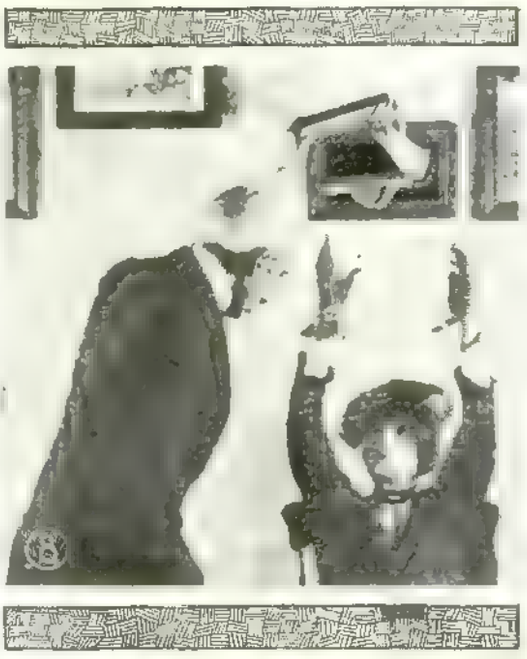
And Yet People Would Have Us Believe that Communication with the Spirit World is a Possibility. There Are Many Amongst Us Now Who Are Thoroughly Convinced That Communication with the Dead is Possible, and Tell us Stories of Remarkable Effects Which a Medium Has Produced. We Have Openly Challenged Each and Every Medium in the United States and in Other Countries to Come Forward and Give Us One Authenticated Phenomenon, One Instance Wherein a Disinterested Committee Will State that Communication is Established Beyond Doubt, While Our Investigators Are Present. The Number of Mediums Willing to Accept Our Challenge (Which, if Conditions Are Lived Up to, Would Mean $11,000 to the Medium, Who May, However, Compete for Any of the $1,000 or $5,000 Prizes), Were Conspicuous by Their Absence. So If You Have Any Friends Who Claim the Powers of a Spiritist, Just Inform Them That We Are Willing to Pay a Good Price for an Authentic Manifestation

Fake Spiritualists



A Detective Investigating Spiritual Mediums Concealed Himself Behind the Trap Door, Which the Would-be Spirit is Opening in Photo No. 6 Above. Here He Saw How the Famous Medium Managed to Materialize the Spirit of a Departed Relative. The Human Spirit Walking Very Quietly on the Thickly Carpeted Floor Entered the Spirit Cabinet by Sliding Beneath the Curtains.

In the Photo Below the Medium Has Taken Advantage of a Very Clever Deceptive Means. Having First Secured a Picture of the Beloved and Departed Son, He Takes a Photograph of This Picture Producing a Negative, and Makes a Glass Positive from It. This Positive He Places Under a Glass Sheet in the Developing Table. When the Mother Visits One of the Seances She is Told to Bring Her Own Plate Packed in Her Own Plate Holder With Her. A Picture of Her is Taken with Her Own Camera Placed in the Medium's Studio. The Mother Then Takes the Exposed Plate in its Holder into the Dark Room, and She Herself Places it into the Developing Bath. On a Pretext That One of the Chemical Bottles Have Been Displaced, the Medium Covers the Glass Developing Tray with a Sheet of Black Cardboard, and Turns on the Light in the Room. At the Same Time He Causes a Lamp Beneath the Developing Table to Light and Produces an Effect Exactly Similar to Contact Printing. Needless to Say the Image is Reproduced on the Plate. This is Further Shown in Fig. 10



The Spirit Form (a Draped Assistant Covered with White Gauze Previously Dipped in Phosphorescent Paint), Having Entered the Dark Cabinet Where the Medium is Bound Both Hand and Foot, Takes Its Place Behind the Medium and After the Curtains Have Been Opened, the Spirit Form Glides Softly Out of the Cabinet Almost Within Grasp of the Spectators.

In Photo 8 Shown at the Left, the Mother in Search of Information Regarding Her Son Has Written a Question on a Slate. This Slate is Covered with Another. The Medium Then Takes it from the Victim's Hand, Raises it High Above Her Head, and Tells Her to Stretch Her Hands Up for it. In Doing So an Assistant in Back of a Would-Be Picture, Makes a Rapid Exchange of Slates, and the Poor Self-Deluded Individual Receives Her Answer to the Question, Not Knowing That There Has Been an Exchange Made, Because She Does Not Believe That Deception Can Be Practised in Such a Short Space of Time.

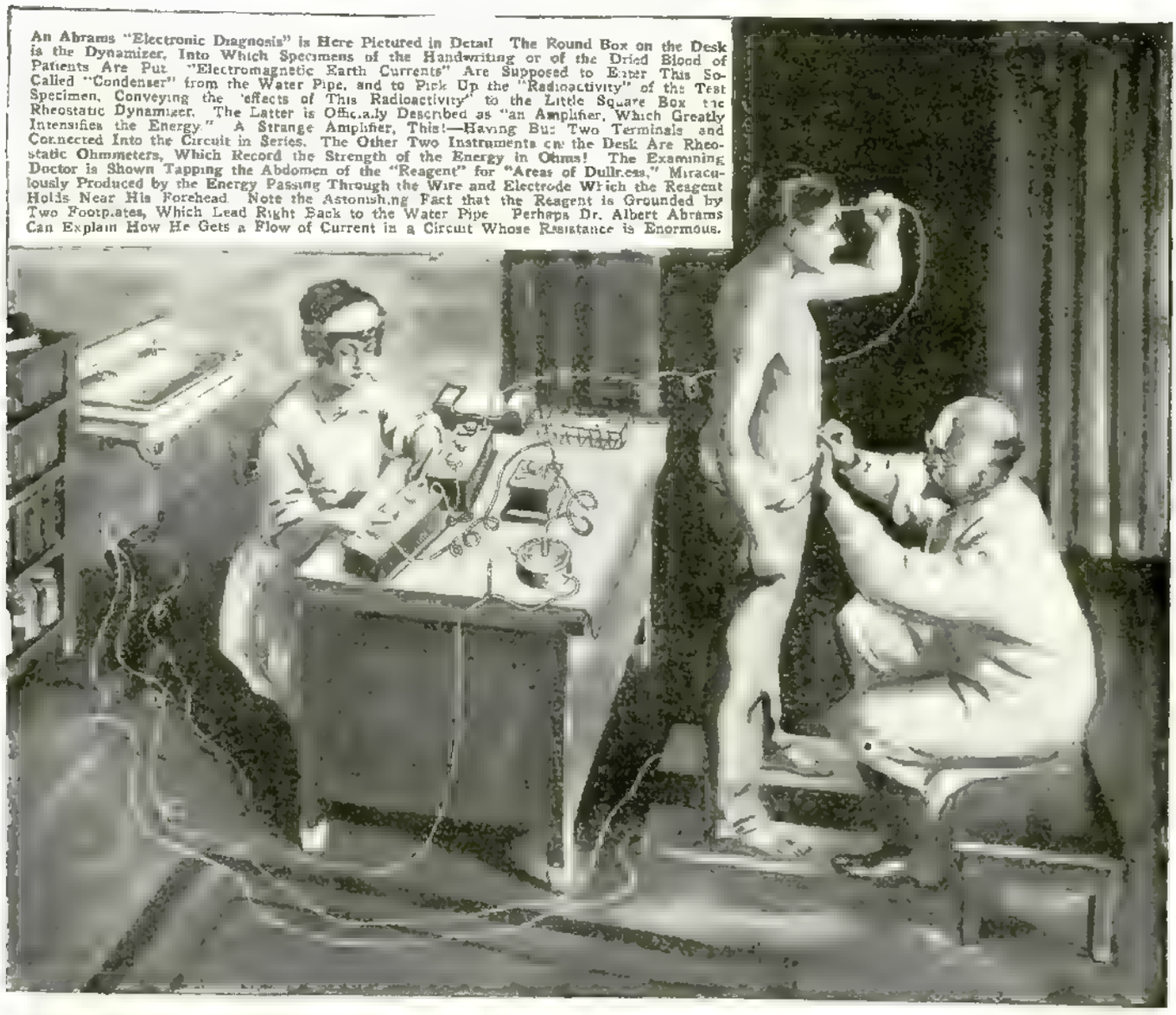
In the Photo Below, Fig. 10, is the Finished Plate Produced by the Method Outlined in Photo 9

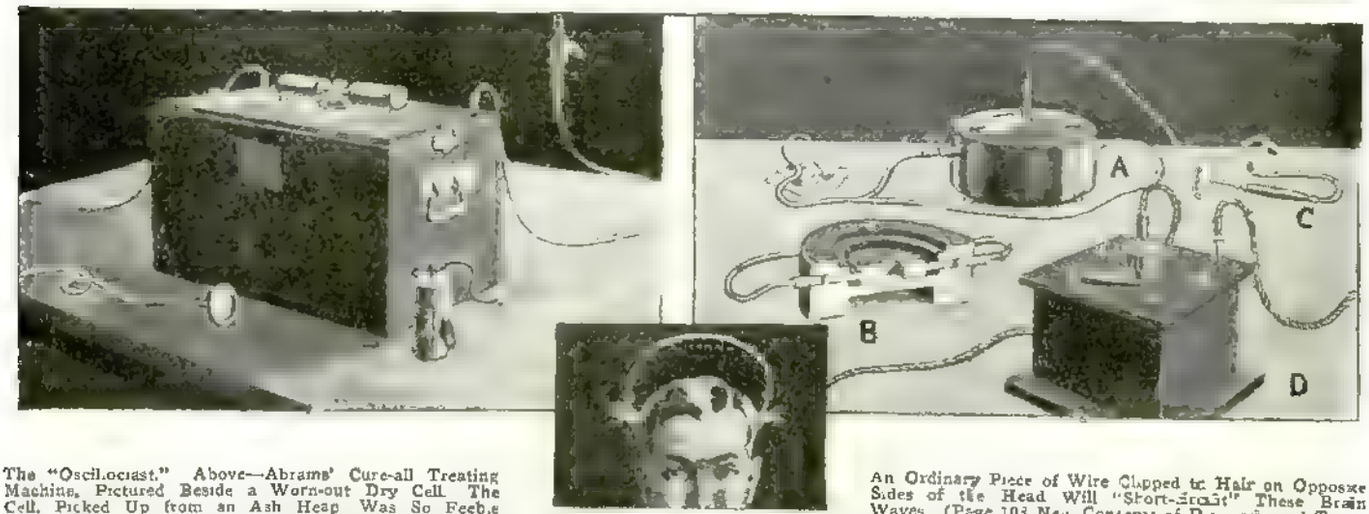
A Modern Charlatan

By A. B. TRIPP

WE HAVE HAD MANY LETTERS FROM OUR READERS REGARDING DR ABRAMS SUPPOSED ELECTRONIC CURES. WE GIVE OUR OPINION BELOW.

An Abrams "Electronic Diagnosis" is Here Pictured in Detail. The Round Box on the Desk is the Dynamizer, Into Which Specimens of the Handwriting or of the Dried Blood of Patients Are Put. "Electromagnetic Earth Currents" Are Supposed to Enter This So-Called "Condenser" from the Water Pipe, and to Pick Up the "Radioactivity" of the Test Specimen, Conveying the "effects of This Radioactivity" to the Little Square Box the Rheostatic Dynamizer. The Latter is Officially Described as "an Amplifier, Which Greatly Intensifies the Energy." A Strange Amplifier, This!—Having But Two Terminals and Connected Into the Circuit in Series. The Other Two Instruments on the Desk Are Rheostatic Ohmmeters, Which Record the Strength of the Energy in Ohms! The Examining Doctor is Shown Tapping the Abdomen of the "Reagent" for "Areas of Dullness," Miraculously Produced by the Energy Passing Through the Wire and Electrode Which the Reagent Holds Near His Forehead. Note the Astonishing Fact that the Reagent is Grounded by Two Footplates, Which Lead Right Back to the Water Pipe. Perhaps Dr. Albert Abrams Can Explain How He Gets a Flow of Current in a Circuit Whose Resistance is Enormous.



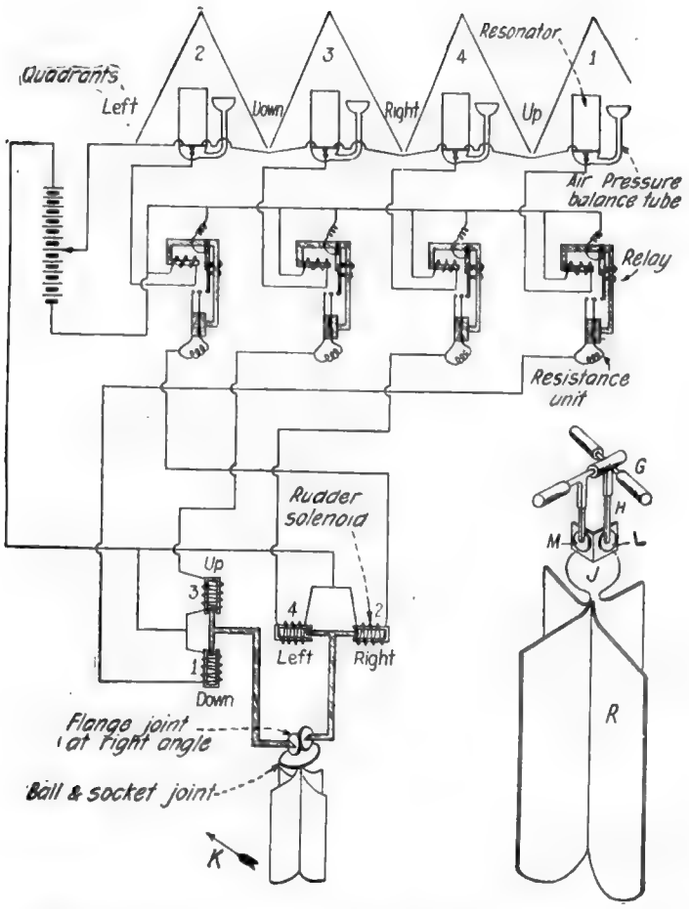


The "Oscilloclast." Above—Abrams' Cure-all Treating Machine, Pictured Beside a Worn-out Dry Cell. The Cell, Picked Up from an Ash Heap, Was So Feeble That it Would Scarcely Run a Doorbell for More Than Two or Three Seconds. Yet This Old, Burst Cell Running Its Doorbell Was a Very Hercules of Power as a Generator of Electronic Oscillations When Compared with the Glorified Electric Buzzer Towering Impressively Above It. The Only Energy That the Oscilloclast Generates is Sound, Noise. Small Center Picture Shows How Abrams "Short-circuits" the Brain. "Brain Waves May Be Conducted Through Wires," Says Dr. Abrams.

An Ordinary Piece of Wire Clapped to Hair on Opposite Sides of the Head Will "Short-Circuit" These Brain Waves. (Page 108 New Concepts of Diagnosis and Treatment by Dr. Albert Abrams.) Above a Close-up View of the "Diagnostic Instruments." A—"The Wonderful Little Dynamizer," Which Abrams Pretends is a "Condenser." B—The Dynamizer Cut in Two, After the Cover Electrode Has Been Removed. Note the Two Aluminum Electrodes Inside Upon Which the Wrapped-up Blood Specimen is Placed. C—A Brow Electrode, with Rubber Rim to Prevent Metallic Contact with the "Reagent's" Skin. D—The Abrams Rheostatic Dynamizer.

Sound Of 'Plane Attracts Aerial Torpedo

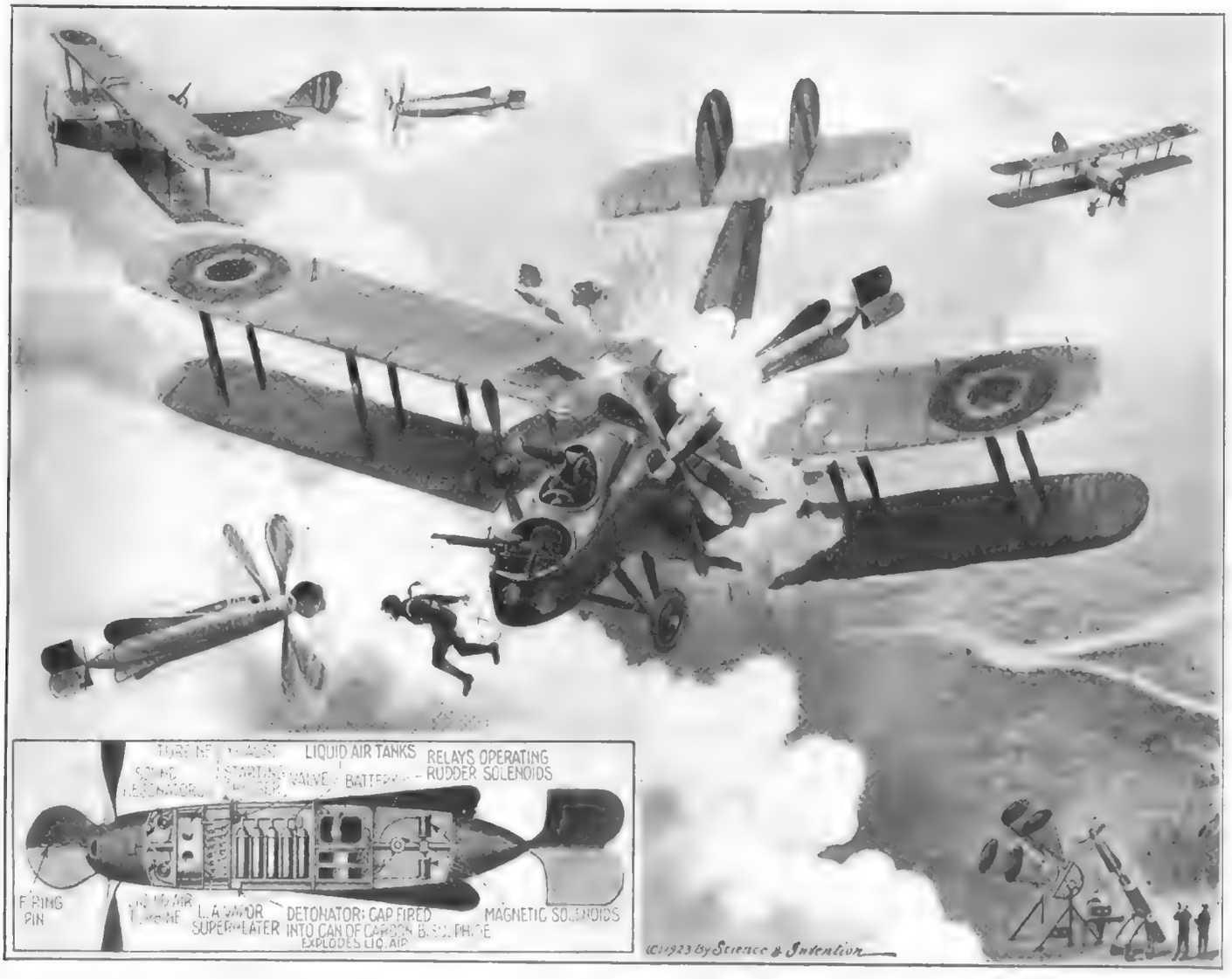
By RAYMOND F. YATES



This New Aerial Torpedo Which Follows the Trail of An Airplane As Tenaciously As Does the Proverbial Bull Dog On the Trail of the Unhappy Tramp, Is the Invention of Dr. Sidney Morton Baruch. The Electrical Circuits Shown in Schematic Form at the Left Serve to Show How the Various Resonators or Sound Detectors, Mounted in the Nose of the Aerial Torpedo, Act On Magnetic Relays Which Open and Close the Circuits to the Magnetic Solenoids Controlling the Steering Rudders of the Device.

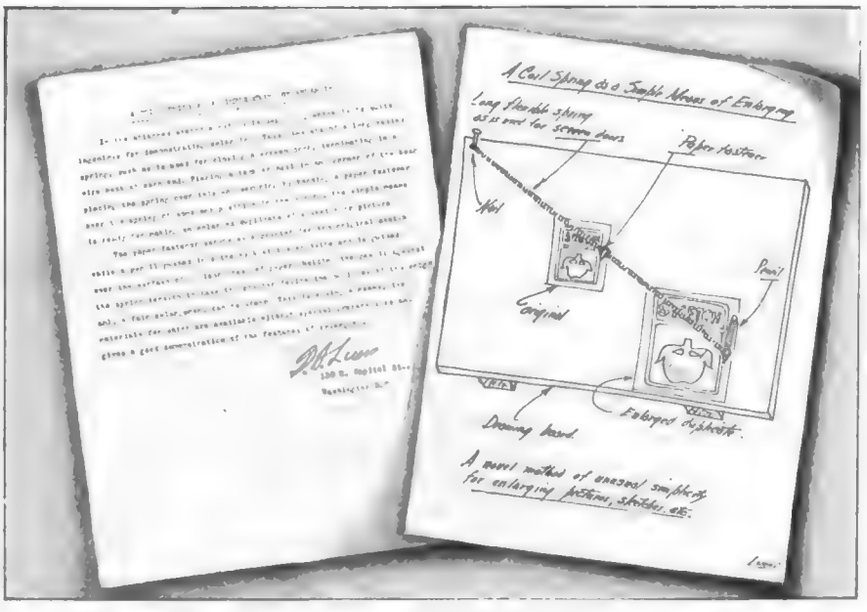
The Aerial Battle Scene Shown Below in Full Activity Makes Clear Just How the Sound-Attracted Aerial Torpedoes, Once They Have Been Shot From the Earth, Follow the Plane With Deadly Accuracy. The Large Horns Shown in the Lower Right-Hand Corner Serve to Collect the Sound From An Airplane Toward Which They Are Trained, and the Pitch of This Sound Is Accurately and Quickly Measured. The Sound Resonators in the Aerial Torpedo to Be Fired at the Plane Are Then Tuned to the Particular Sound of the Craft to be Attacked—and Away It Goes On Its Winged Mission of Destruction. Every Airplane Has a Different Sound so That the Feasibility of this Scheme Seems Well Substantiated.

The Detailed Drawing (Lower Left-Hand Drawing) of the Baruch "Blood-Hound of the Air" Shows the Liquid Air Storage Tanks and Super-Heater, Together With Liquid Air Turbine for Propelling the Torpedo, as Well as the Electro-Magnetically Controlled Rudders Actuated by Microphones Attached to the Sound Resonators. If the Sound is Strongest from Below Then the Rudders Are Turned so as to Cause the Torpedo to Go in That Direction, and Vice Versa.


LIQUID AIR TANKS
RELAYS OPERATING RUDDER SOLENOIDS
F. PIN
DETONATOR: CAP FIRED INTO CAN OF CARBON BISULPHIDE EXPLODES LIQ. AIR
MAGNETIC SOLENOIDS
©1923 By Science & Invention

$12,000 or More in Prizes

LOOK over this issue of SCIENCE AND INVENTION and get acquainted with its new make-up and new ideas expressed therein. Note particularly that hereafter SCIENCE AND INVENTION will tell its scientific news primarily in pictures. In order to do so, the Editors must have the pictures in the first place. It being impossible for us to collect all the material personally, we have to rely upon our readers, not only for pictures, but for suggestions as to articles to illustrate, hence the prize contest.

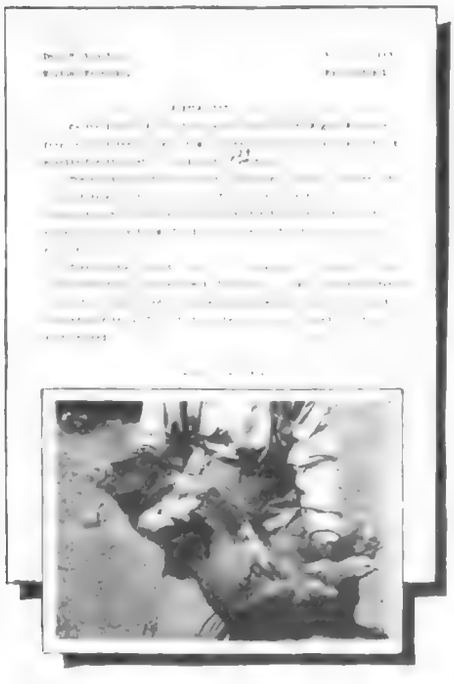

A Coil Spring as a Simple Means of Enlarging
Long flexible spring as is used for screen doors
Paper fastener
Nail
Pencil
Original
Drawing board
Enlarged sketch
A novel method of unusual simplicity for enlarging pictures, sketches, etc.

This Is an Example of the Way Articles Should Be Submitted. They Need Not Be Typewritten, However.

Beginning with the January issue, SCIENCE AND INVENTION will pay the sum of $1,000 or more per month to its readers for one year or longer, for pictures and ideas for illustrations.

A study of this issue will show you what we are aiming to do. You will note that *we are trying to make difficult scientific subjects intelligible to the layman.* In other words, we claim that any scientific subject can be told in pictures.

If in the future you walk along the street and see something new that has not been described previously, send that idea to us with a sketch, drawing, or photograph, or if you cannot do either, just an explanation of the idea written in intelligible English. We will then make our own illustrations. *For every such idea accepted, whether accompanied by a picture or not,* we will pay a prize. BUT ALWAYS REMEMBER THAT THE IDEA MUST HAVE SOMETHING TO DO WITH SCIENCE OR INVENTION. Otherwise it cannot be accepted.



If Submitting Photographs—the Above Illustration Will Show How to Do It.

The highest prizes will be awarded for the best suggestions considered from an editorial viewpoint. Second best, third best, et cetera, will be judged in a like manner. A long article is not necessary, nor desired. Illustrations should be accompanied by not more than 500 words, less if possible. If a good picture is to be had, and if you have no camera, it will pay you to borrow one or have a friend or professional take the picture.

What we do not want are ideas that have been published before, either by us or by some other periodical. We must have original matter.

If you know any new experiment; a new wrinkle; a new formulae; write it up with a small sketch, and send it in to us.

All such contributions sent to this Magazine, will be paid for in the form of prizes. Note particularly that every Department will pay a series of prizes for articles accepted for that department. Make a start now—perhaps you will win one of next month's awards.

Some illustrations will require full pages; others will require only one column space 2" high. But so far as the prizes are concerned, it makes no difference if the illustration which represents the idea is printed by us in large or small space. *It is the idea that counts in all cases.* In the event of a tie for any of the prizes the identical prize will be awarded to each contestant so tying.

A small illustration has just as good a chance to win a prize as a large one. Every illustration will be accompanied by the name of the author. Prizes will be published every month in SCIENCE AND INVENTION. We have so many and varied departments in SCIENCE AND INVENTION that it will be very easy to win.

A few good examples of "How to do it" are shown on this page. Of course, we do not publish the illustrations or the entire text as submitted. Illustrations are redrawn by our artist and the text "boiled down" into a caption.

When submitting an idea, be just as brief as possible. A few little free hand sketches are often better than 500 words.

Rules of the Contest:

1: No article must be any longer than 500 words.

2: Contestants may send in more than one contributions there is no restriction as to number.

3: All entries must be executed in type or ink; no penciled matter is eligible. Always make sketches on a separate sheet of paper.

4: All entries on which no prizes have been awarded, will be returned to contestants, providing return postage is attached.

5: All prizes are paid monthly, upon publication.

6: Address all entries to *Editor*, SCIENCE AND INVENTION, 53 Park Place, N. Y. City.

$12,000 or More in Gold!

SCIENCE AND INVENTION magazine, beginning with the JANUARY issue, will pay prizes of $1,000 or more a month, or $12,000 for the year.

88 monthly prizes will be given as follows:

FIRST	**PRIZE**	**$100.00**	
2	**PRIZES of**	**$50.00**	**each**
10	"	25.00	"
5	"	20.00	"
10	"	15.00	"
20	"	10.00	"
10	"	5.00	"
20	"	2.00	"
10	"	1.00	"

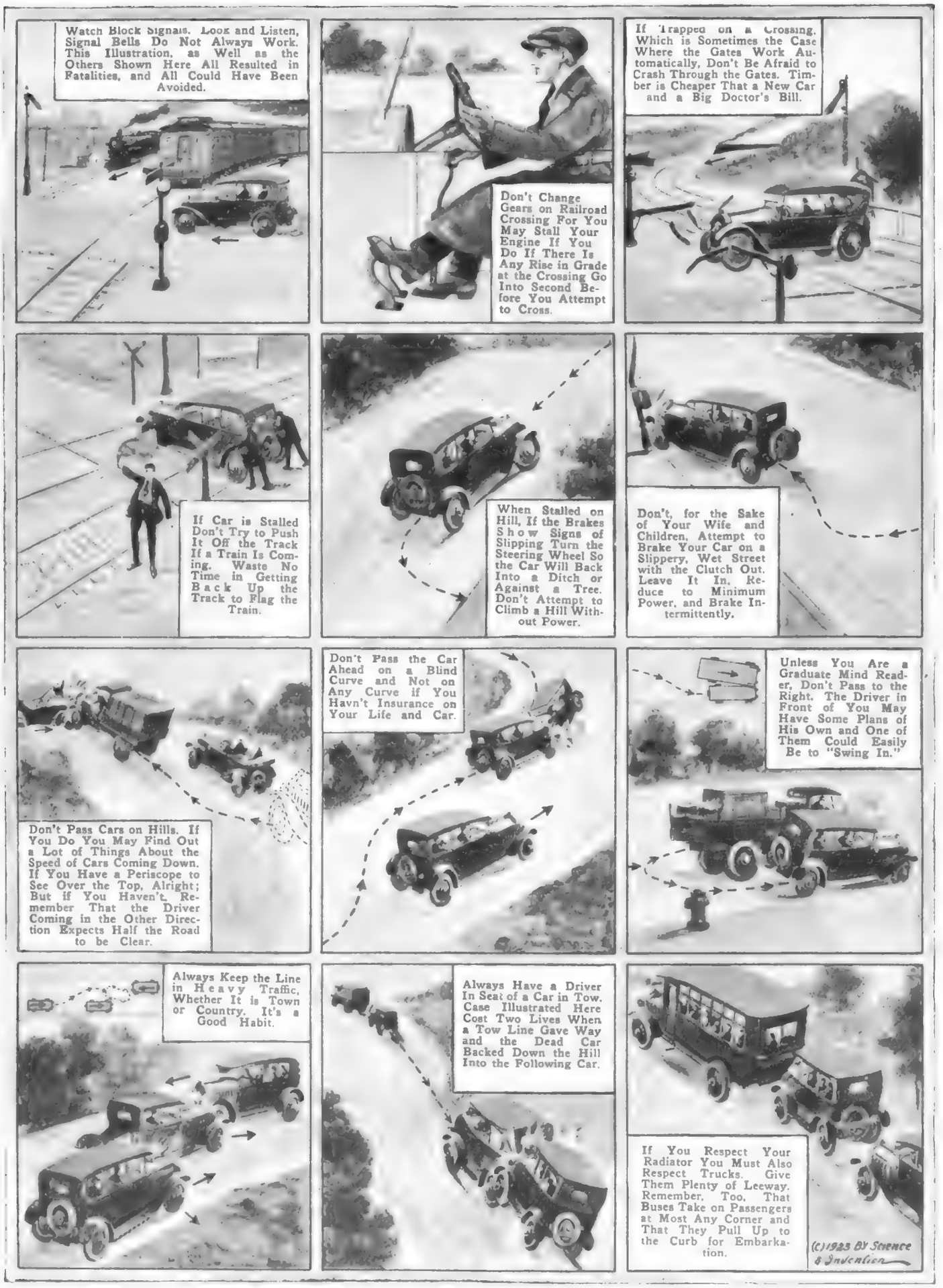
The closing date for all prize contributions will be the 15th of the month preceding date of issue, i.e., 15th of November for the January number; the 15th of December for the February number, etc. All manuscripts must reach us by this time of the month for the respective issue.

World's Largest Falls

Kaieteur Falls, a Great Unharnessed Giant to Engineers and a God to Poets, Lies in the Heart of British Guiana and in the Superb Beauty Becoming the Greatest Waterfall in the World, Serenely Rolls Its Millions of Horse-power Into Nothingness. Towering 741 Feet from Brink to Kettle, it is Taller Than Niagara Put Atop the Washington Monument. If That Isn't Fall Enough; the River Slopes Off 81 Feet More in the Thousand Feet Below Kaieteur. The Potaro River, Which Tumbles Over This Drop, is 369 Feet Wide, and in Flood Time, the Sheet of Water at the Brink is Fifteen Feet Deep. The Potaro is a Tributary of the Essequibdo. Hidden Deep in the Heart of the Jungle, Few White Men Have Seen the Falls, a Sight for the Gods.

How To Avoid Auto Accidents

By H. WINFIELD SECOR, E. E.


Watch Block Signals. Look and Listen, Signal Bells Do Not Always Work. This Illustration, as Well as the Others Shown Here All Resulted in Fatalities, and All Could Have Been Avoided.
Don't Change Gears on Railroad Crossing For You May Stall Your Engine If You Do If There Is Any Rise in Grade at the Crossing Go Into Second Before You Attempt to Cross.
If Trapped on a Crossing, Which is Sometimes the Case Where the Gates Work Automatically, Don't Be Afraid to Crash Through the Gates. Timber is Cheaper That a New Car and a Big Doctor's Bill.
If Car is Stalled Don't Try to Push It Off the Track If a Train Is Coming. Waste No Time in Getting Back Up the Track to Flag the Train.
When Stalled on Hill, If the Brakes Show Signs of Slipping Turn the Steering Wheel So the Car Will Back Into a Ditch or Against a Tree. Don't Attempt to Climb a Hill Without Power.
Don't, for the Sake of Your Wife and Children, Attempt to Brake Your Car on a Slippery, Wet Street with the Clutch Out. Leave It In, Reduce to Minimum Power, and Brake Intermittently.
Don't Pass Cars on Hills. If You Do You May Find Out a Lot of Things About the Speed of Cars Coming Down. If You Have a Periscope to See Over the Top, Alright; But if You Haven't, Remember That the Driver Coming in the Other Direction Expects Half the Road to be Clear.
Don't Pass the Car Ahead on a Blind Curve and Not on Any Curve if You Havn't Insurance on Your Life and Car.
Unless You Are a Graduate Mind Reader, Don't Pass to the Right. The Driver in Front of You May Have Some Plans of His Own and One of Them Could Easily Be to "Swing In."
Always Keep the Line in Heavy Traffic, Whether It is Town or Country. It's a Good Habit.
Always Have a Driver In Seat of a Car in Tow. Case Illustrated Here Cost Two Lives When a Tow Line Gave Way and the Dead Car Backed Down the Hill Into the Following Car.
If You Respect Your Radiator You Must Also Respect Trucks. Give Them Plenty of Leeway. Remember, Too, That Buses Take on Passengers at Most Any Corner and That They Pull Up to the Curb for Embarkation.
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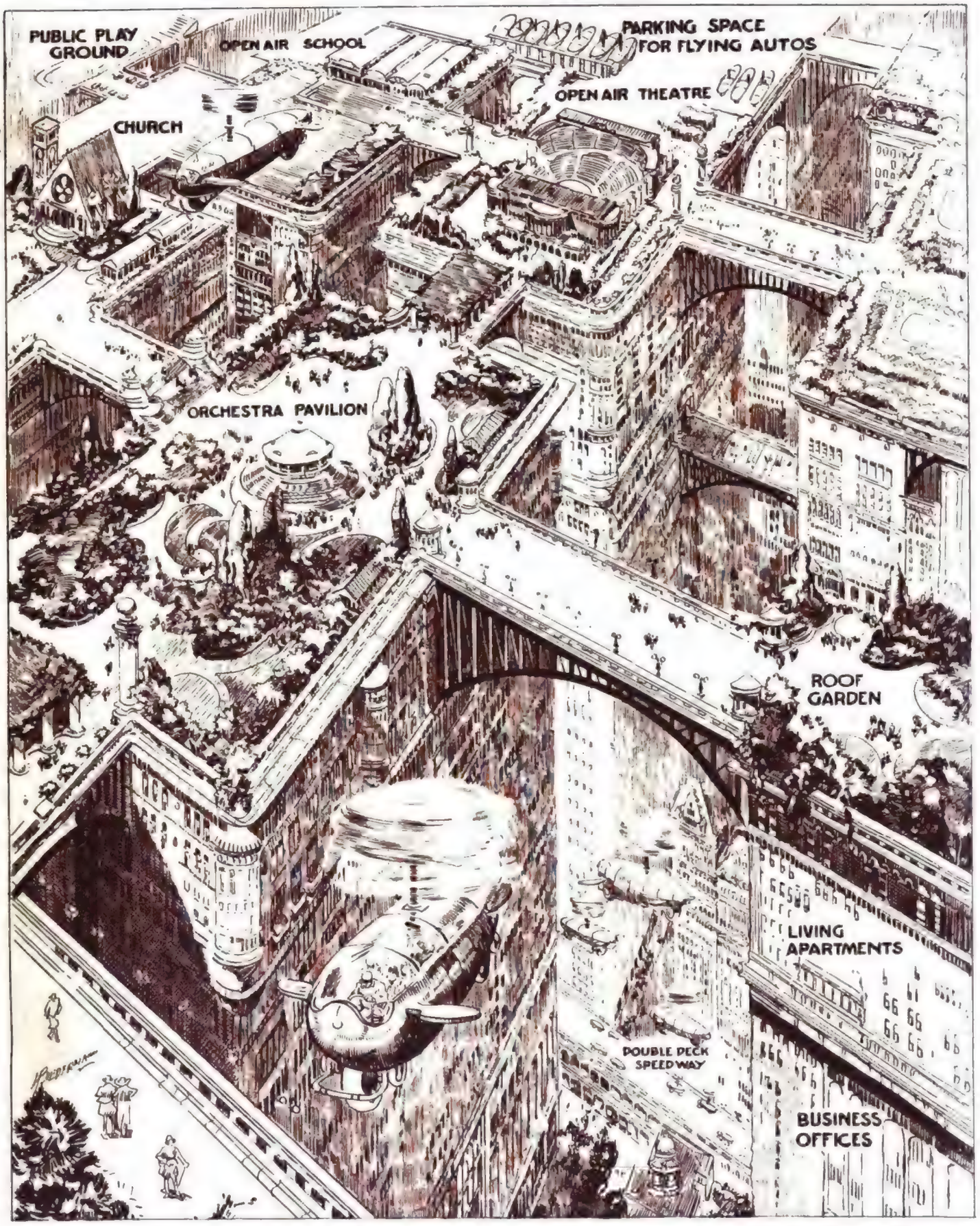
Our Cities of The Future

By H. GERNSBACK



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In Europe, as a Rule, People Do Not Travel To and From Business, Taking from 15 Minutes to an Hour on an Average in Doing So. Usually They Live Near Their Place of Business, and Often Just Over Them. The Illustration Shows an American City of the Future Which Will Do Away with the Useless Traveling Which Nearly All of Us Do To-day. At Present, This Travel Means a Huge Loss of Time. It Means Car Fare and Inconvenience. In the Future, the Cities Will Be Laid Out with Business Buildings Covering Entire Blocks as Seen Above. Atop These Will Be Apartments Where People Will Live. The Parks, Restaurants and Landing Places for Airplanes, Will Be on Top of the Apartments. The Top Levels Will Be Connected by Bridges. The Advantages of This Plan Are so Huge it is Surprising the Idea Has Not Been Tried, as Yet, on a Large Scale. To Be Sure, in New York, There Exists To-day Many Roof Gardens Upon Which Even Large Trees Grow.

Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

No. 21
Dr. Hackensaw's Trip To the Moon

(Author's Note. In my story last month I called attention to a fact which seems to have been overlooked by all previous chroniclers of interplanetary trips,—namely that the direction and velocity of the projectile depend more upon the rotation of the earth on its axis, and the speed and position of the earth in its revolution around the sun, than it does upon the initial force of seven miles per second, with which the car is shot off into space. In the present story I call attention to another overlooked fact, namely that the passenger in the car, during the entire trip, would be apparently freed from the attraction of gravitation.)

(Beg Pardon, Mr. Fezandié as to the latter statement. See "Baron Münchhausen's Scientific Adventures" by H. Gernsback, July, 1915 issue "Electrical Experimenter."—Editor.)

"IS everything ready for the start?"

"Yes, doctor. The last touches have been given and I'll take my oath that everything is in apple-pie order. The wheel will start turning in ten minutes, and the car will be released for its flight to the moon at precisely 27 minutes 31 73/100 seconds past three o'clock. The release will be made automatically when the chronometer reaches this point."

"That's good. An error of a small fraction of a second would mean that my car would miss the moon, and go wandering off into space. But what in the world can be delaying Silas Rockett. He was to have come with me. Ah, here he is!"

As Doctor Hackensaw said these words, the reporter came up breathlessly.

"Doctor," said he, "I'm awfully sorry, but I can't go with you as I expected. My fiancée, Gloria Mundy won't let me! She's afraid to let a handsome man, like me, run loose among the lunar beauties. Besides, she doesn't believe I'd ever get back, and she has no use for a sweetheart two-hundred-and-forty thousand miles away."

Doctor Hackensaw's face fell, for the idea of making the trip alone was by no means a pleasant one.

"Never mind, Silas," said he genially. "It's too bad you can't come, because if the inhabitants of the moon chance to be cannibals, I'm afraid there won't be enough of me alone to make a meal for the royal palace or palates. But never mind. I'll do the best I can without you."

He spoke cheerfully, but it was with a heavy heart that he entered the car that was to bear him on his strange journey. Everything seemed in order, oxygen tanks, provisions, and an ample water supply. Each article was securely fastened, although the internal car was pivoted in an external shell, so as to always remain upright while the car was whirled around at the frightful speed necessary for the start.

Two beds, or rather, two couches had been prepared for the passengers. These were designed for the comfort of the travelers in starting. Doctor Hackensaw absent-mindedly opened the wrong couch—the one intended for the reporter. Imagine his amazement when out jumped a young girl of about twenty, who laughingly held out a hand to him.

". . . Doctor Hackensaw Hesitated a Moment, Then Said: 'Very Well. I'll Open the Window for Just a Second, So as Not to Allow Too Much Air to Escape; be Ready, and Throw the Bag Out Quickly.' Suiting the Action to the Word, He Opened the Casement and the Young Girl Hurled the Paper Package Forth with All Her Might. Away It Sped as if Shot from a Cannon, and, Lighted Up by the Sun's Rays, it Looked for all the World Like a Shooting-Star.

"How do you do, doctor?" said she. "I'm glad to meet a fellow-passenger."

"My dear young lady," cried the startled doctor. "Who are you, and what in the world are you doing here? Quick, you must get out of this, for the car will start immediately."

"My name is Pepita Perkins," replied the young girl, "but of course all my friends call me "Pep." I'm a reporter for the New York *Daily Growl*. I heard that Silas Rockett wasn't coming with you, so I thought I'd take his place."

"But I can't possibly allow you to come to the moon with me," cried the doctor, aghast. "Quick, let me open the door, or better still, I'll sound the alarm to warn my foreman not to start the car!"

"No you don't!" cried the young lady, throwing herself between him and the door. I'm stronger than you are, doc, so force would be useless. I'm here, and here I'm going to stay. Ah! Here we're starting. It's too late now! You know yourself that if there's the slightest delay now, all your work will be wasted, for your Ferris wheel would no longer be aimed in the right direction, and a new one would have to be built."

It was but too true, as Doctor Hackensaw well knew. Still he tried one more appeal.

"My dear young lady," he pleaded. "Don't you realize the danger? The chances are that we won't reach the moon alive, and even if we do reach it, we shall probably never come back. And think of your reputation. Think of the scandal that will be attached to your name for having come alone with me on this wild trip!"

"It will make a dandy sensational story for the *Daily Growl*," replied the young lady, with a toss of her pretty head. "Gee! It'll be the scoop of the season!"

Doctor Hackensaw perceived that it would be useless to reason with this obstinate young girl. Pep Perkins was evidently determined to go along with him, and he must make the best of the matter.

The car by this time was revolving with some speed, as the Ferris wheel to which it was attached, was gaining velocity at each revolution. Both parties were obliged to hold tight to special handles arranged along the car.

"Miss Pepita. . . ." began the doctor.

"Call me Pep, please," interrupted the young lady.

"Well, Miss Pep. You don't seem to realize that we shall soon be whirling around in a circle at the rate of seven miles per second, and barely time to secure ourselves in our couches. It would be utterly impossible to hold on to these straps. Besides, in order to avoid the bad effects of the dizziness, I am going to take ether and you must take some, too. We shall thus be asleep when the car is rotating at its greatest speed."

"Then you consent to take me along with you?" cried the young girl, overjoyed, and she impulsively threw both arms around the doctor's neck and kissed him enthusiastically.

Doctor Hackensaw's face softened, and he looked at her with a fatherly gaze, as he muttered to himself:

"Poor girl! She is only a child yet! If we ever get back from this trip. . . ."

But he didn't finish his sentence. Time was too precious.

"Get into your couch, quick!" said he, "and I'll turn your ether supply on for you. There is just the right amount to keep you asleep until we are shot off."

The young girl obeyed. A moment later the doctor locked himself in his own couch and turned on his personal supply of ether. Then he lost consciousness.

Meanwhile the speed of the wheel, to which the car was fastened, had been gradually increased until it had attained its maximum. And now the chain, which held the car to the wheel, was gradually allowed to unwind from its windlass, so that the car gradually ascended beyond the circumference of the wheel, thus revolving in ever increasing circles. You have seen a boy whirling a weight around at the end of a string, and gradually letting out the string so that the weight turns in larger and larger circles. This was precisely the same thing, but on a greater scale.

Finally, the car had attained the requisite velocity of seven miles per second, and made two or three revolutions at this frightful speed. Then came the decisive moment for which the alarm was set. At the very instant when the chronometer indicated the seventy-third hundredth of the second for which the start was scheduled, the car was automatically released from the chain that held it to the earth, and went shooting off into space!

The spectators who watched it gave an "ah!" of astonishment and dismay as they saw the metal of the external shell become red-hot, owing to the friction of the air as the car passed through the earth's atmosphere, for the car was traveling so fast, that, although the start was made in the

rarefied air of a high mountain, the resistance of this air was enormous during the first second of flight, and not only retarded the velocity of the car considerably, but produced an intense heat. Luckily the doctor had provided for this by means of refrigerating agents in the walls, and by others that played on the outer shell. Otherwise serious damage would have been done, both to the car and its occupants. After the first few seconds of flight, however, the air became so rarefied as to be negligible.

In a very short time the car itself was out of sight, but astronomers followed the new meteorite with their telescopes, for even after it lost its heat, it still shone in the heavens, as a planet shines, by reflecting the light of the sun. The newspapers reported its progress hour by hour, and that night the New York *Daily Growl* issued an extra with a wireless message from the occupants of the car. The article was headed: "Lady Passenger in the Car for the Moon"—It was the scoop of the season, and the circulation of the paper rose to an unprecedented height.

Meanwhile, what was happening in the car? "Pep" was the first of the two passengers to awaken. She opened the top of her couch and looked out. In spite of the doctor's precautions she felt dizzy and nauseated from the rapid spinning she had undergone. After a few moments, however, she felt a little better, and grasped a handle to pull herself to a sitting position. Luckily she held fast to the handle, for, to her surprise, her body kept rising, and soon her feet were in the air and her head downward, while she clung frantically to the berth. It was not difficult, however, to pull herself down again.

"Gee!" she cried, "that's funny! I must have slept two or three days, and we're now at the spot between the earth and the moon where there's no gravitation. I must wake up the doctor."

As she said the words, the cover of the doctor's couch slowly opened, and that worthy looked out. He, being older, had suffered even more from the dizziness than the young lady. It took him some minutes to recover from his daze. Then he attempted to rise from his couch. But he neglected to hold on to the handle, and up he shot to the top of the car, spinning around in a circle as he rose.

For the life of her, Pep could not help laughing as she watched these strange antics and saw the poor doctor strike the top of the car, and then bounce down again like a rubber ball. Twice up and twice down he went before Pep was able to catch hold of him to stop his flight, and then, inadvertently relaxing her own grip on the handle, she was carried up with him on the rebound. Round and round went the pair, clinging to each other, and revolving as they rose. These acrobatics would have continued for quite a while, had not Pep been dexterous enough to catch hold of a handle at the third trip, and thus brought them both to a stop.

"Gee!" said she, "that's queer! I had no idea things would act like this when they had no weight! Where are we now, doc?"

Doctor Hackensaw had finally managed to gather his wits together, and, replied: "I can't see the telemeter from here. This is the instrument that tells our distance from the earth. But I think, if you move carefully, you can swim up slowly through the air and take a look at the dial. I'm too giddy to try it myself."

Pep tried the experiment, and found that by relying only upon the movements of her hands, without any initial push, it was easy to swim through the air in any direction, though her arms at first went like windmills, for the speed of each motion, now that her body had no weight, was about sixteen times as great as it would have been under normal conditions. However by slowing down her efforts, she avoided this, and reported that the dial indicated 5987 miles from the earth.

"How does this instrument work?" she asked.

"I had my choice of several methods," replied the doctor, "but selected this as the simplest. An automatic wireless signal is sent me from my laboratory every second.

(*Continued on page* 597)

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". . . Twice up and Twice Down He Went Before Pep Was Able to Catch Hold of Him to Stop His Flight, and Then, Inadvertently relaxing Her Own Grip on the Handle, She Was Carried Up with Him on the Rebound. Round and Round Went the Pair, Clinging to Each Other, and Revolving as They Rose. These Acrobatics Would Have Continued for Quite a While, Had Not Pep Caught Hold of a Handle at the Third Trip.

Around the Universe

By RAY CUMMINGS

4TH INSTALLMENT

CHAPTER VI (Concluded)

THE audience was held in front of the vehicle, with Tubby, Sir Isaac and Ameena sitting on the floor in its doorway while a circle of guards kept back the crowd of giants that had collected. Within this circle the Great Mogul and his four Wisest Men stood.

Tubby felt as though he weighed over four hundred pounds—which indeed was the case; and his companions in proportion.

"It's just like being a Lilliputian in Gulliver's Travels," he whispered to Sir Isaac as the Great Mogul kneeled down to see him more closely. Tubby was struggling for breath; a great weight seemed compressing his chest his head was ringing his eardrums felt as though something were pushing them inward—all, as Sir Isaac had explained an hour before, because of the excessive pressure of the Jovian atmosphere. It was most disagreeable. And especially it was unpleasant to be nailed down by one's own weight—to be forced to interview the greatest monarch of the Solar System in an undignified sitting posture on one's own doorstep!

"Saturn, a Globe Almost as Large as Jupiter and with its Marvelous System of Rings Very Much Larger, at This Proximity Was a Magnificent Sight. As Viewed from the Vehicle's Present Position, the Concentric Rings—the Inner One Somewhat Darker — Were Opened Up to an Angle of Nearly Thirty Degrees—a Glistening, Gleaming Silver Band, Like the Broad Brim of a Crownless Hat Encircling the Planet. It Was a Most Glorious Sight."

Sir Isaac beamed when Tubby made his remark about the Lilliputians. "Ah, so you *have* read my 'Gulliver's Travels?' There was a book! If I do *say* it myself, my scientific conceptions in that were——"

"Sh!" Tubby whispered. "He's talkin' to us!"

Tubby noticed suddenly that the Great Mogul and all his followers had very big, flat feet—shaped like snow-shoes—as though they were meant for walking on very soft surfaces. They——

The Great Mogul was talking in a huge, roaring voice. The words were strange, unintelligible.

Sir Isaac smiled with embarrassment; and shook his head. "Too bad," he whispered to Tubby. "I *ought* to know their language—but I don't. You see I've never written much about Jupiter. I——"

A little Jovian stepped forward—a stoop-shouldered, weazened individual no more than nine or ten feet tall. By his face he might have been two or three hundred years old. He looked more like a giant mummy than a man.

"I speak your Earth-language," he said. "All of them—the languages of the Solar System are my study."

Tubby felt impressed. He whispered to Sir Isaac;

"Looks like he'd been studyin' too much, don't he? Mean lookin' guy, huh perfessor?"

The Interpreter added:

"His Supreme Highness demands that you explain your mission."

Sir Isaac did so, respectfully but eloquently outlining the nature of the disaster that threatened the Earth from Mars and Mercury, and ending by pleading most earnestly that the great Jovians lend their aid to the Earth to prevent so murderous an attack.

The Interpreter turned to his master and translated. When he had finished, the Great Mogul laughed!

The three voyagers knew then, before an answering word was spoken, that their mission to Jupiter was a failure. They had made their plea—the lives of all the teeming millions of people of the Earth were at stake—and the Great Mogul laughed!

"That dirty, mean——" Tubby would have broken into open villification, but Sir Isaac stopped him.

The Great Mogul was now speaking to his Interpreter.

"His Supreme Highness the Great Mogul is extremely sorry," said the Interpreter a moment later.

"Yes, he looks it." This from Tubby.

The Interpreter's face darkened as he repeated this sarcasm to his master. A torrent of passionate anger swept over the Great Mogul's face. The Interpreter listened to his words a moment; then, in translating them his anger made him lapse into an Earth-colloquialism more expressive than elegant.

"His Supreme Highness says all you little worlds can shoot yourselves to Hell for all *He* cares," said the Interpreter.

Tubby tried belligerently to rise to his feet, but his weight made the effort a lamentable failure.

"We're sorry," Sir Isaac shouted at once. "Tell His Highness we meant no offense. . . . These Jovians are most hot-tempered people it would seem." He added this last to Ameena in an undertone.

(*Continued on page* 604)

SYNOPSIS OF THREE PRECEDING INSTALLMENTS OF "AROUND THE UNIVERSE."

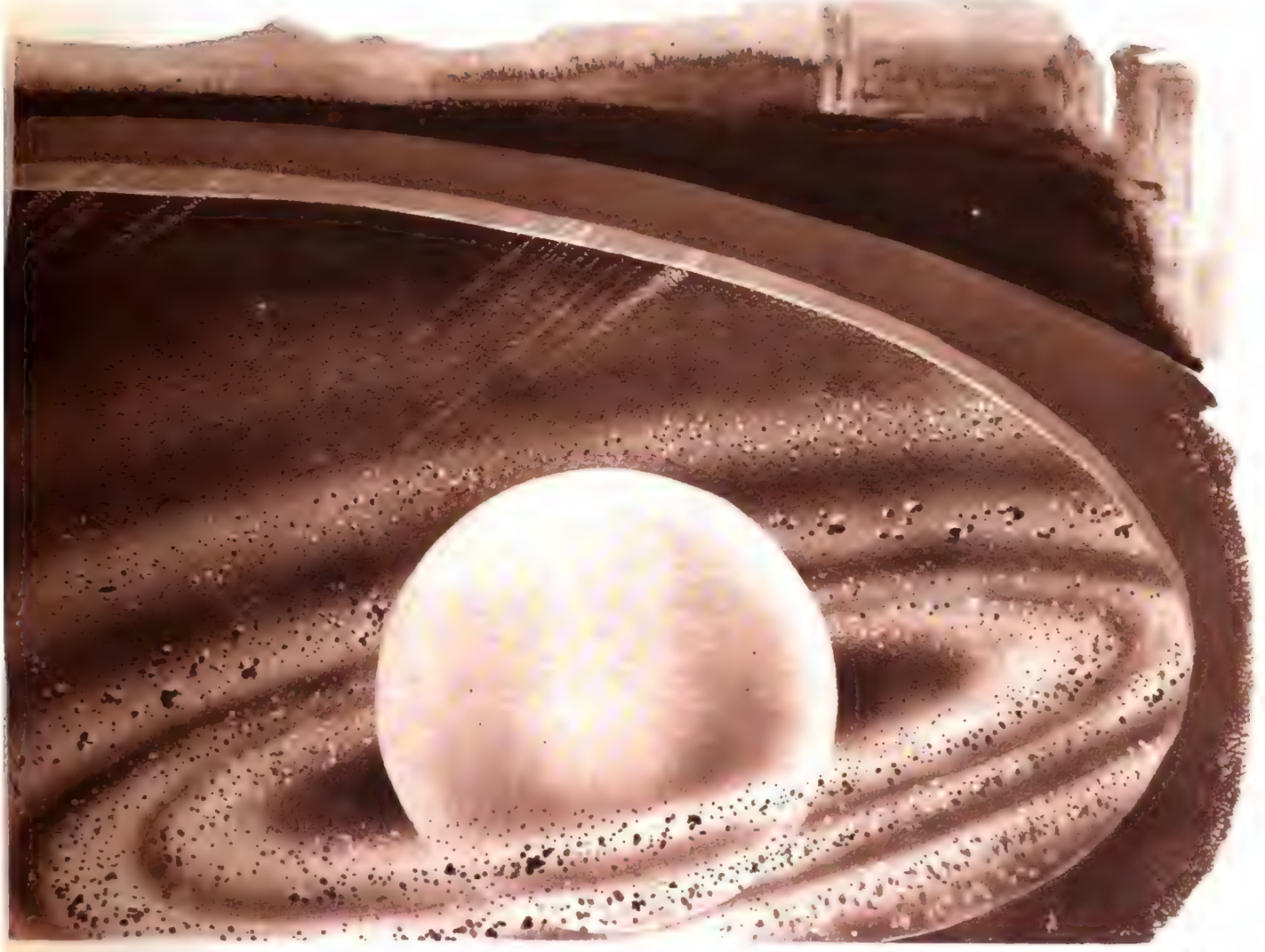
WHILE watching a game of cards "Tubby" suddenly finds himself out in the open under the stars. He also finds that he has been endowed with a power of wishing and having his wishes come true. He wishes that he could know all about the stars and astronomy and there appears before him a man who introduces himself as Professor Isaac Swift DeFoe Wells-Verne. The Professor tells "Tubby" that he will teach him all about astronomy. Tubby then wishes that he could travel everywhere in the universe and before them appears a space flyer which Sir Isaac says is his invention. They start for Venus.

Landing on Venus, they meet a young lady whose name is Ameena. She tells them that the earth is in danger. Her people have found out that the Martians are about to descend upon the Earth and conquer it. Emissaries from both Mars and the Twilight People of Mercury, as the latter are going to assist the Martians, have been to Venus and tried unsuccessfully to enlist the aid of the Venusians. She says that the armies of Mars and Mercury have already conquered the Moon and placed outposts there.

The Professor decides that they must go for help to the Light Country located on Mercury, as its inhabitants are not going to enter into the war.

The people inhabiting the Light Country of Mercury refuse to assist the people of the Earth in the threatening War. After an altercation with the King of the Light Country, the space Travelers go back into their machine and launch forth into space.

The voyagers decide to travel to Jupiter and solicit aid of the inhabitants. They head toward Jupiter and come upon it on the hot side which is still in a molten state. However, they circle around the planet and land upon the solid side. Upon landing they are granted an audience with the Great Mogul of Jupiter at 12 o'clock noon, Earth Eastern time.



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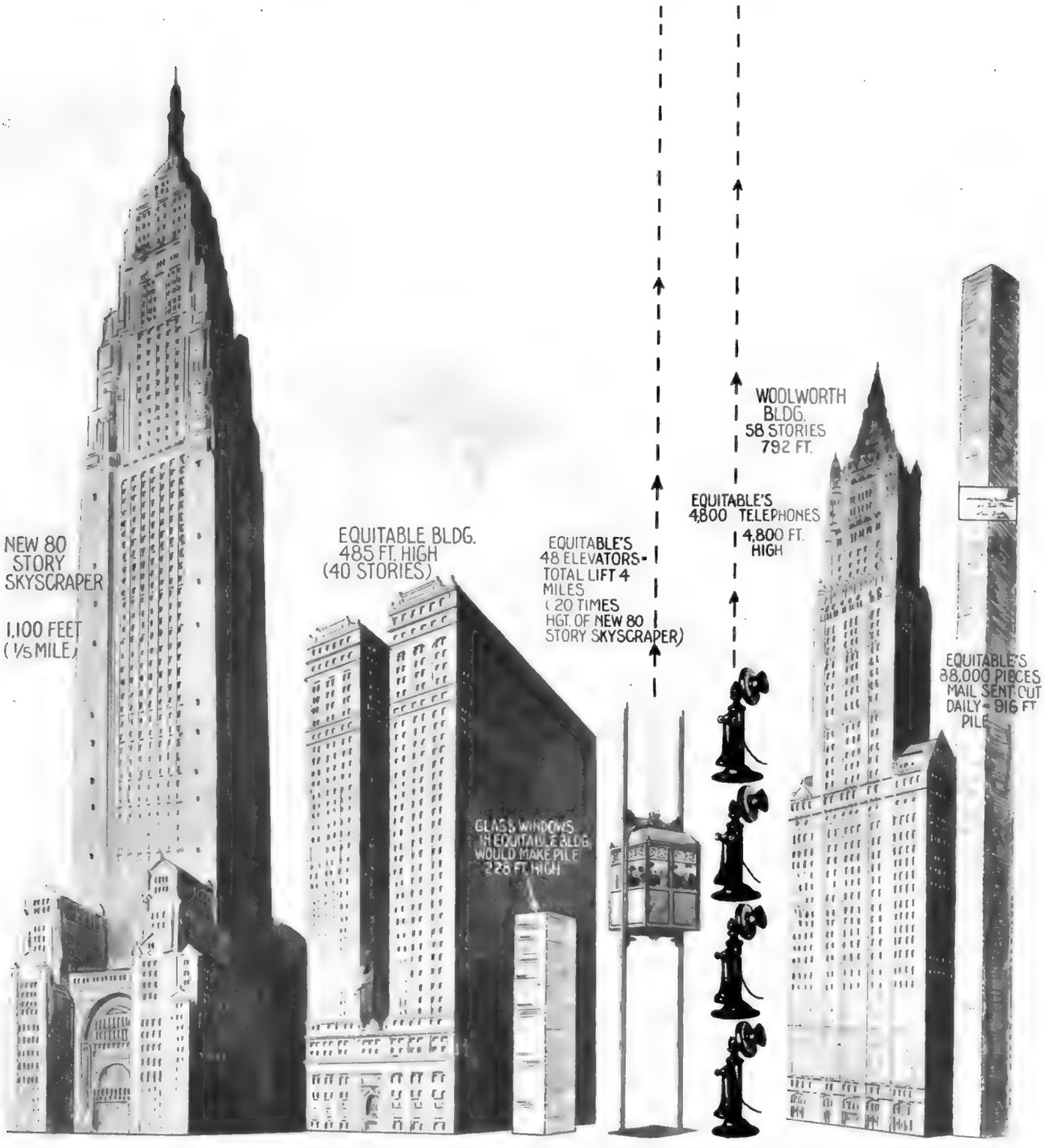
Sky-Scraper To Tower 80 Stories


NEW 80 STORY SKYSCRAPER
1,100 FEET (⅕ MILE)
EQUITABLE BLDG. 485 FT. HIGH (40 STORIES)
GLASS WINDOWS IN EQUITABLE BLDG. WOULD MAKE PILE 228 FT. HIGH
EQUITABLE'S 48 ELEVATORS - TOTAL LIFT 4 MILES (20 TIMES HGT. OF NEW 80 STORY SKYSCRAPER)
EQUITABLE'S 4,800 TELEPHONES
4,800 FT. HIGH
WOOLWORTH BLDG. 58 STORIES 792 FT.
EQUITABLE'S 88,000 PIECES MAIL SENT OUT DAILY - 916 FT PILE

With the Announcement of Plans, Drawn by Bertram Grosvenor Goodhue, for the Erection of an Eighty-Story Office Building to be Built on the Site of Madison Square Garden, New York, Some of the Problems of Caring for Such a Building After Construction Are Illustrated Here. When Built, the Tall Central Tower Will Reach 1,100 Feet Into the Air, Nearly a Fifth of a Mile Above the Street Level. It Will, of Course, be the Largest Office Building in the World.

The Illustration Shows It Compared with the Two Other Large Buildings, The Woolworth and the Equitable. Each Day, 88,000 Pieces of Mail Fall Through the Chutes That Run From the Top to the Bottom Floors of the Equitable Building. Were They Stacked in One Huge Pile, the Resulting Stack Would Tower 916 Feet Into the Air, or 124 Feet Higher Than the Woolworth Tower. The 14,000 People Who Daily Earn Their Bread in the Equitable Building Talk Over 4,800 Feet of Telephones—That is, They Would if the Telephones Were Stacked. The Ordinary Desk Instrument is Just a Foot Tall.

There Will Have to be Quite a Few Elevators in the New Skyscraper, Too. Every Time the Forty-eight Elevators of the Equitable Building Make a Complete Trip They Rise a Total Distance of Four Miles. More than 90,000 People Use These Cars Every Day. The Equitable Still Remains the Largest Office Building in That It Houses the Greatest Number of Persons.

The Glass in Its Windows, if Stacked, Would Reach a Height of 228 Feet. Ten Men Wash Them But They Never Get Through. Before They Get Clear Around the First Ones Are Ready for Another Bath. The Foundations Upon Which the New Building Must Rest Will Need a Great Deal of Attention. The Equitable Foundations Go Ninety Feet Below the Surface of the Street and the Piles That Hold the Woolworth Tower Are Sunk 110 Feet Into the Ground.

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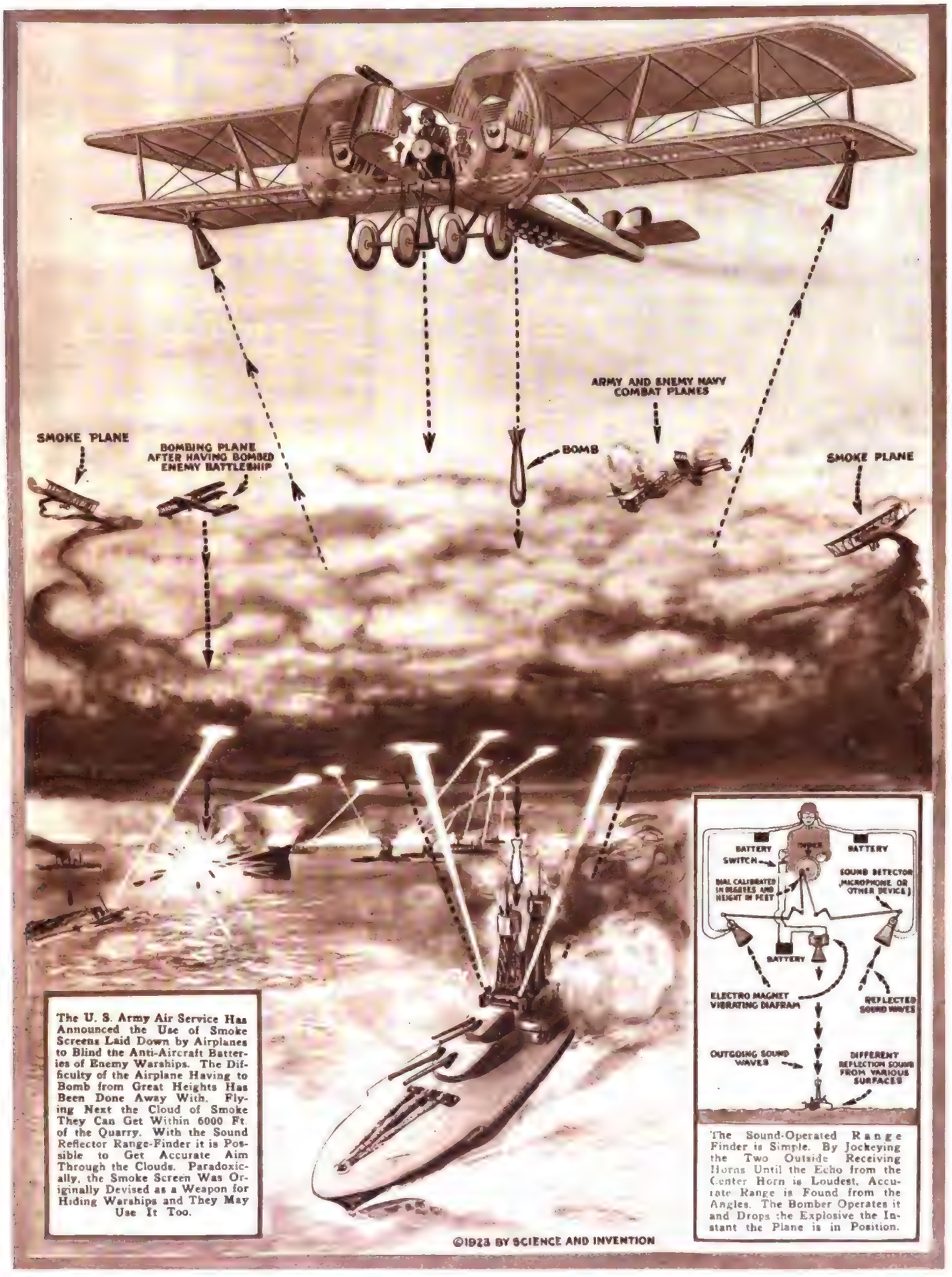
Smoke to Hide Bombing Planes



The U. S. Army Air Service Has Announced the Use of Smoke Screens Laid Down by Airplanes to Blind the Anti-Aircraft Batteries of Enemy Warships. The Difficulty of the Airplane Having to Bomb from Great Heights Has Been Done Away With. Flying Next the Cloud of Smoke They Can Get Within 6000 Ft. of the Quarry. With the Sound Reflector Range-Finder it is Possible to Get Accurate Aim Through the Clouds. Paradoxically, the Smoke Screen Was Originally Devised as a Weapon for Hiding Warships and They May Use It Too.

The Sound-Operated Range Finder is Simple. By Jockeying the Two Outside Receiving Horns Until the Echo from the Center Horn is Loudest, Accurate Range is Found from the Angles. The Bomber Operates it and Drops the Explosive the Instant the Plane is in Position.

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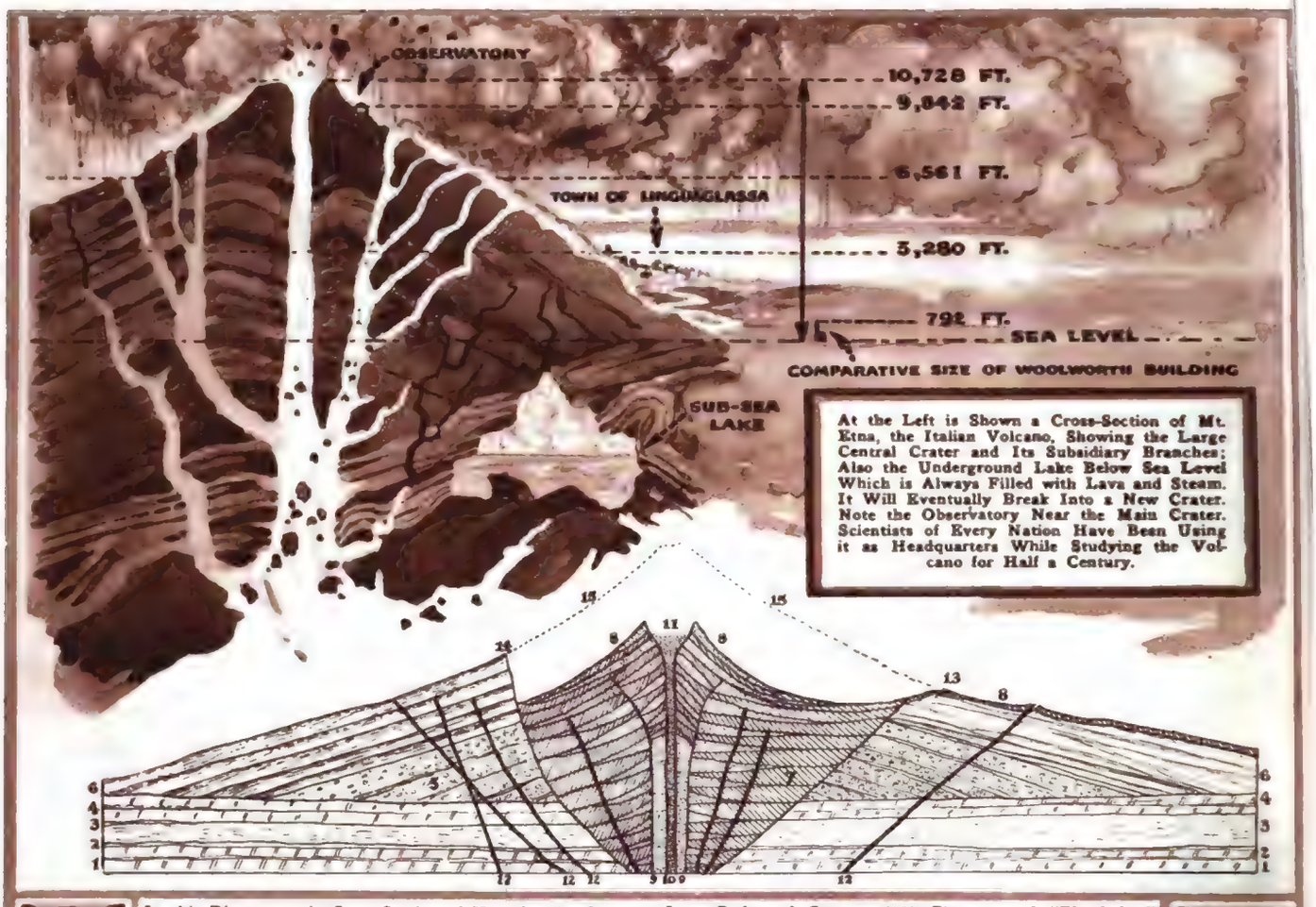
Mt. Etna, Destroyer of Cities



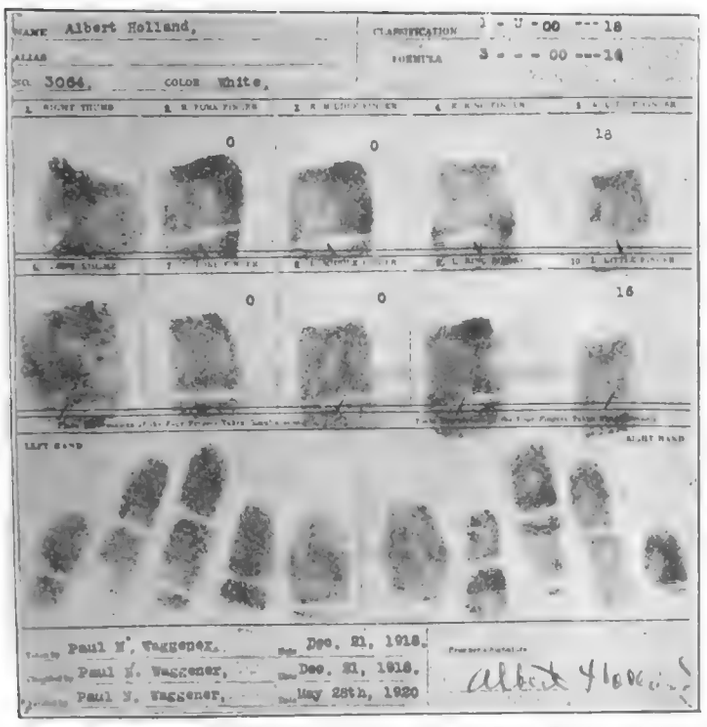
At the Left is Shown a Cross-Section of Mt. Etna, the Italian Volcano, Showing the Large Central Crater and Its Subsidiary Branches; Also the Underground Lake Below Sea Level Which is Always Filled with Lava and Steam. It Will Eventually Break Into a New Crater. Note the Observatory Near the Main Crater. Scientists of Every Nation Have Been Using it as Headquarters While Studying the Volcano for Half a Century.

In this Diagrammatic Cross-Section of Vesuvius the Strata (1) to (6) Are Prehistoric and at One Time Submarine, (7), the Great Crater of A. D. 79, (8) to (11), Modern Lava Beds and Craters, (12) Fissures and "Blowholes," (15), the Original Mountain. The Crater (10) is Always Open, While (9) Opens Only in Great Eruptions.

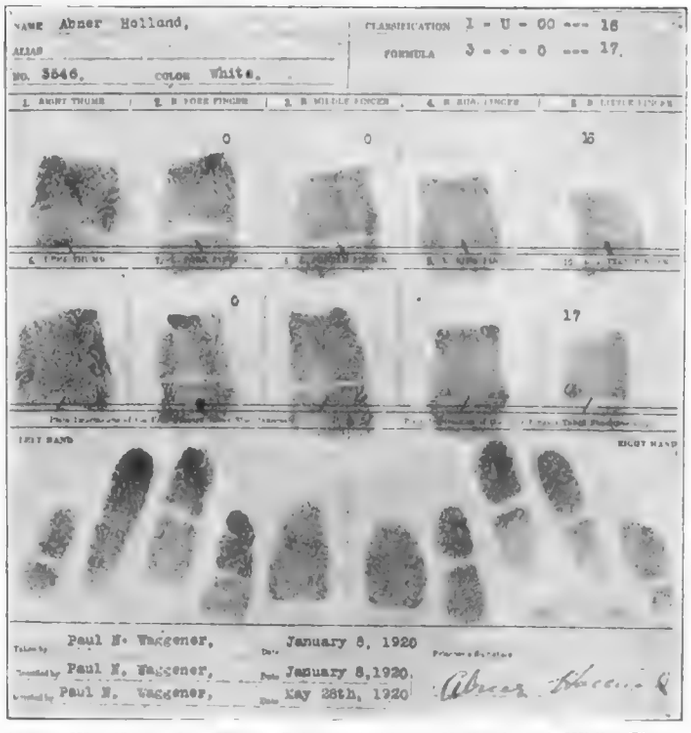
Etna is Shown in Full War Glory (Above) as He Was Last Spring When His Few Days of Playfulness Destroyed a Dozen Towns and Left 50,000 People Homeless. The Clouds Are Composed of Steam and White Ash. For Weeks After the Eruption This Fine Ash Filled the Air for a Radius of Fifty Miles or More Around the Mountain. Although the Lava is Molten and White Hot as it Comes from the Crater, When it Reaches the Foot of the Mountain it is Like a Moving Bank of Hot Mud Pushing Everything, Including Towns, Before it. At the Right is Shown a Smoke Column Several Miles High Floating from the Crater During One of the Less Active Periods.

John Doe--His Fingerprint

By FAIRFAX PROUDFIT WALKUP


NAME Albert Holland,
CLASSIFICATION 1 - U - 00 --- 18
FORMULA 3 - - - 00 --- 14
NO. 3064, COLOR White,
Paul H. Waggener, Dec. 31, 1918.
Paul H. Waggener, Dec. 31, 1918.
Paul H. Waggener, May 28th, 1920

Above Are the Finger Prints of Albert Holland, Twin Brother of Abner Holland, of Memphis, Tennessee. Compare His Finger Prints with Those of Abner on the Left.


NAME Abner Holland,
CLASSIFICATION 1 - U - 00 --- 16
FORMULA 3 - - - 0 --- 17
NO. 5846, COLOR White,
Paul H. Waggener, January 8, 1920
Paul H. Waggener, January 8,1920.
Paul H. Waggener, May 28th, 1920

Above We Have the Finger Prints of Abner Holland and While There is a Difference in Them the Primary Classification is the Same, a Thing Never Recorded for Twins Before.

Look Sharply at the Picture of Albert Holland and See What Kind of a Detective—or Rather "Character Reader"—You Are. Compare This Photograph with That on the Right of Albert Holland.

Well, Folks, We Have to Tell You the Sad Story that Abner Holland Above is the "good boy" of the Twins. They Have a Most Striking Resemblance in Both Facial Appearance and Contour.

WILL YOU BE OUR REPORTER?

IN connection with our $12,000.00 prize contest announced elsewhere, it goes without saying that you will have to hustle to win a prize. The Editors do not wish to make it hard for you; quite the contrary. We want the pictures and want them badly. Herewith is reproduced our reporter's card. We shall be glad to send it to anyone who makes an application. By means of this card, you will be able to secure entré into industrial plants, business houses, motion picture studios, steamships, mines, etc. This card will prove an open sesame to you in many instances. Each card is numbered and only one is given to a correspondent. A postal card from you and a request for this reporter's card is all that is necessary for obtaining one. It will be sent you by return mail. Address Field Editor, SCIENCE AND INVENTION, 53 Park Place, New York City.

REPORTER

Science and Invention

CORRESPONDENT
REPORTER'S
IDENTIFICATION
NO. 999

THE BEARER OF THIS CARD John Doe
IS AN AUTHORIZED CORRESPONDENT - REPORTER OF
SCIENCE and INVENTION MAGAZINE
THE PUBLISHERS OF SCIENCE AND INVENTION WILL APPRECIATE ANY COURTESY EXTENDED THEIR REPRESENTATIVE.

EXPERIMENTER PUBLISHING CO.

(over)

PRESIDENT

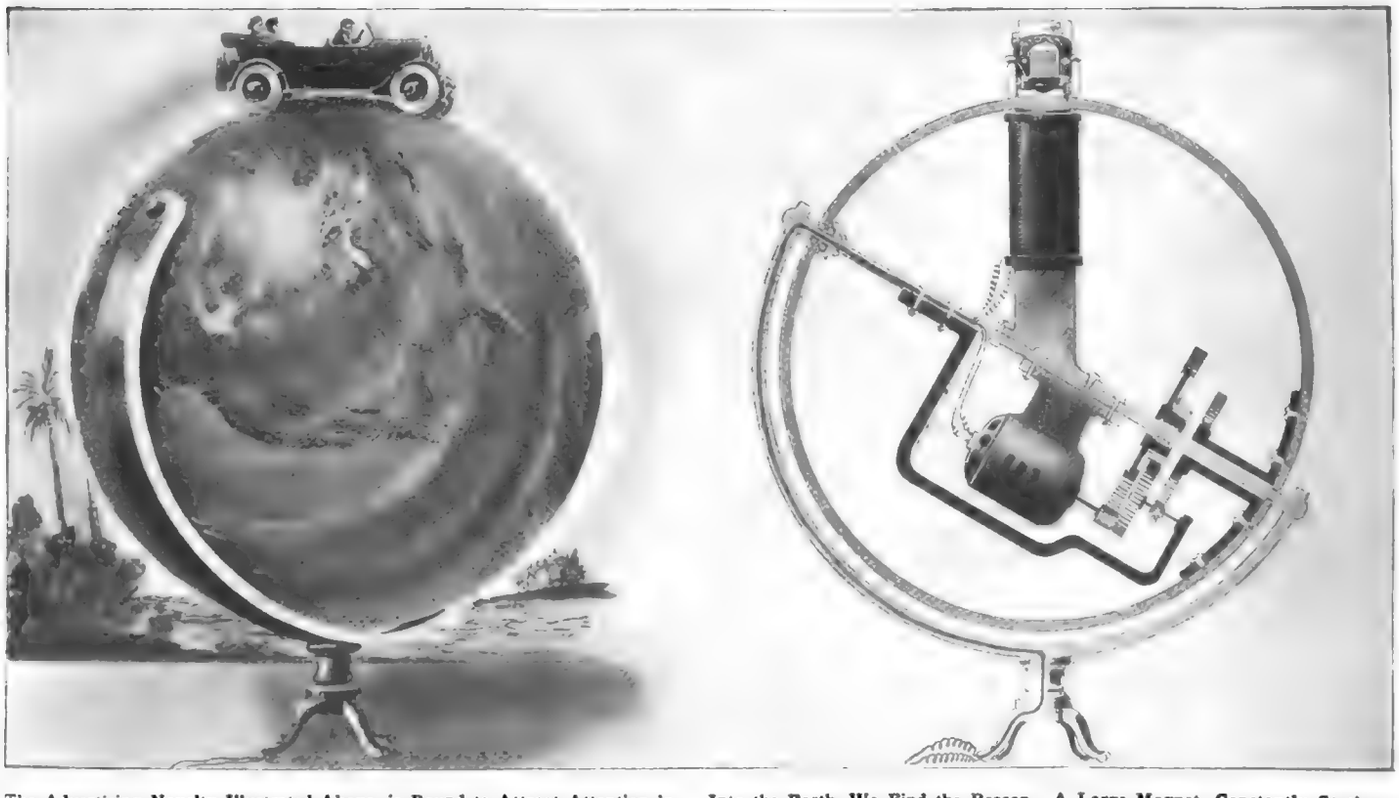
A Flaming Log Sign

By JAMES E. ATHERTON

Flaming Advertisement Shown Above and Likewise Illustrated on the Cover of This Magazine, is One of the Cleverest Advertising Signs Patented. It Consists of Logs Made of an Amber-Colored Glass, in Which Incandescent Lamps Are Located. Slits in the Glass Permit Steam to Pass Out Through the Logs, Which Steam is Illuminated by Colored Floodlights. The Lamps Within the Sign are Flashed on and Off by a Regular Flasher. This is the Invention of Jose De Elorza, of Madrid, Spain.

Magnet Holds Auto While Globe Spins

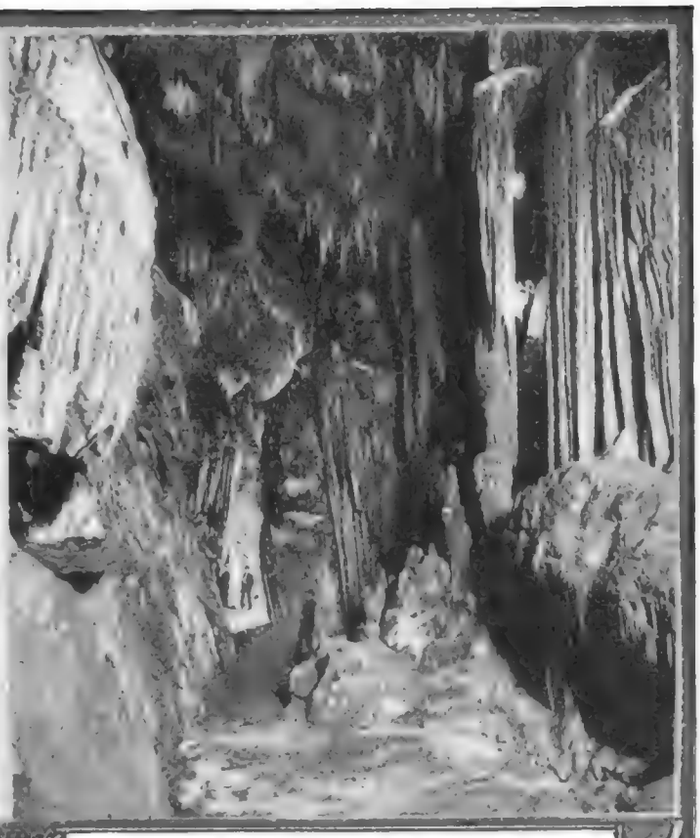
By MARGARET REISS



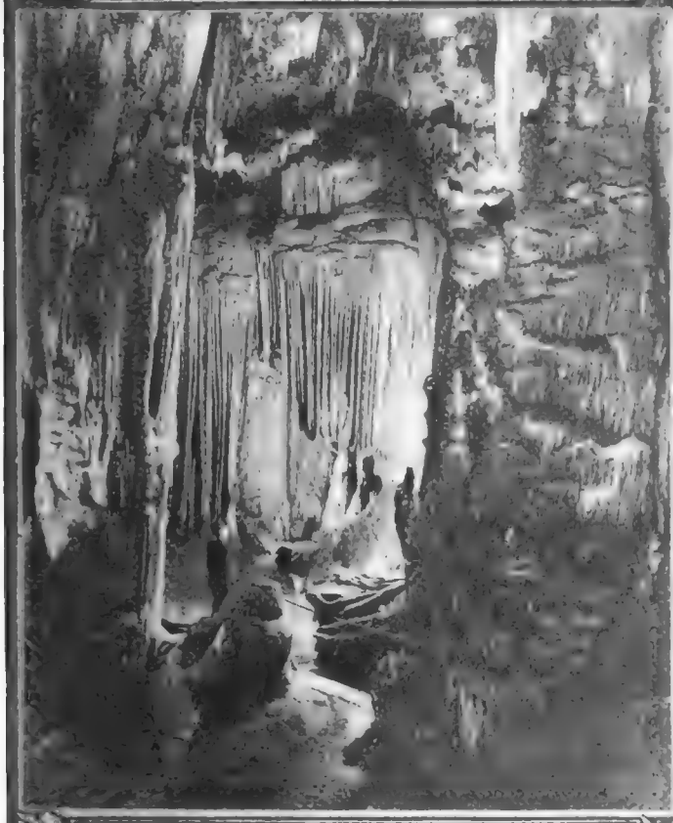
The Advertising Novelty Illustrated Above, is Bound to Attract Attention in Any Store Window, For Regardless How Rapidly the Earth Moves Beneath Car, the Automobile Maintains its Position on the Surface. Looking Into the Earth, We Find the Reason. A Large Magnet, Constantly Stationary, Holds the Miniature Machine Against the Surface of the Globe Rotated by a Concealed Electric Motor. Patented by Thomas G. Craver.

Weird Shenandoah Caverns

This Flashlight Was Taken In the Persian Palace, of the Caverns of Shenandoah, Virginia. Note the Weird Formations.—Photo By Hiserman.



The Tower of Babel, (Grottoes of Shenandoah, Virginia), in the Background is Three Times the Size of Any Known Stalactite Formation in the World.

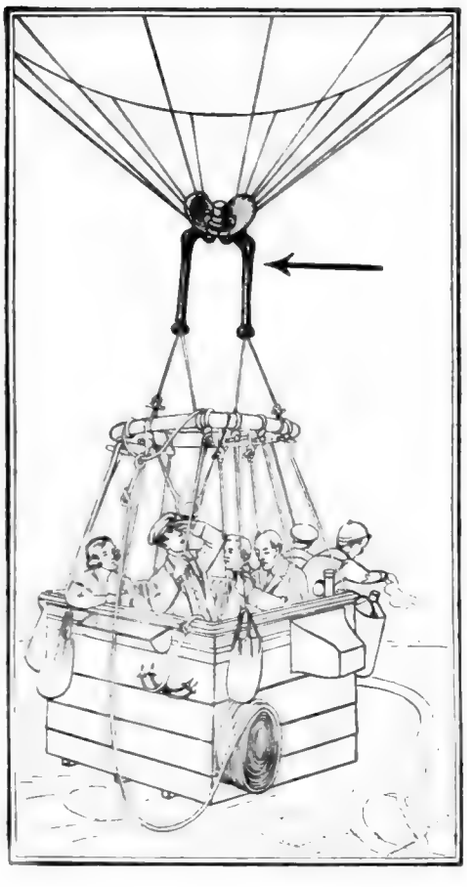


The Luray Caverns in Virginia Have Been Estimated to be Over 7,000,000 Years Old. It required 120 years to Form One Cubic Inch of This Stalactic Formation. — Photo © J. D. Strickler.

Grottoes of Shenandoah, Virginia. The Lime Water Has Dropped From the Top of the Cave Onto This Point Forming a Perfect Oval and Then Running Down the Side Making a Veil.

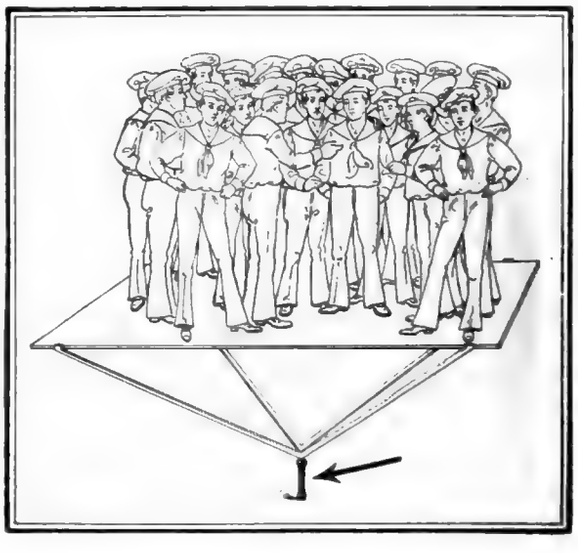
Oddities Of Our Body

An Enlarged Vertical Section Through the Skin Made Near a Cut Would Show Us What is Pictured Above. Here a Large Tortuous Pipe-Like Structure is a Blood Vessel. Through Its Walls White Blood Cells Are Passing Toward the Cut to Devour Germs as They Enter. Notice the Hair on the Surface of the Skin and the Canals of the Sweat Glands. Near the Upper Left Hand Corner the Section Has Just Grazed a Hair and Its Follicle.



At the Left Is Strikingly Illustrated the Great Strength of the Ligaments, Those Tendons Which Hold the Bones in Their Joints. Here the Pelvis Has Been Secured to a Balloon and the Basket of the Balloon is Seen Hanging from the Thigh Bones. The Total Weight Supported Is Over 850 Pounds. The Picture Although Seemingly Fantastic Is Perfectly Justified by Measurements Made Upon the Body.

It Is Not Generally Known That the Compression Strength of the Thigh Bone Exceeds That of Granite Fully Two-Fold, and Is Three Times as Strong as Brick. Cast Iron Succumbs to Pressure at 103,806 Pounds. Bone at 21,333 Pounds, Granite at 8,532 Pounds, Good Wood, 7,110 Pounds and Brick at 711 Pounds. Fully 20 Men Could Stand on the Thigh Bone Without Crushing It, As Shown at the Right.



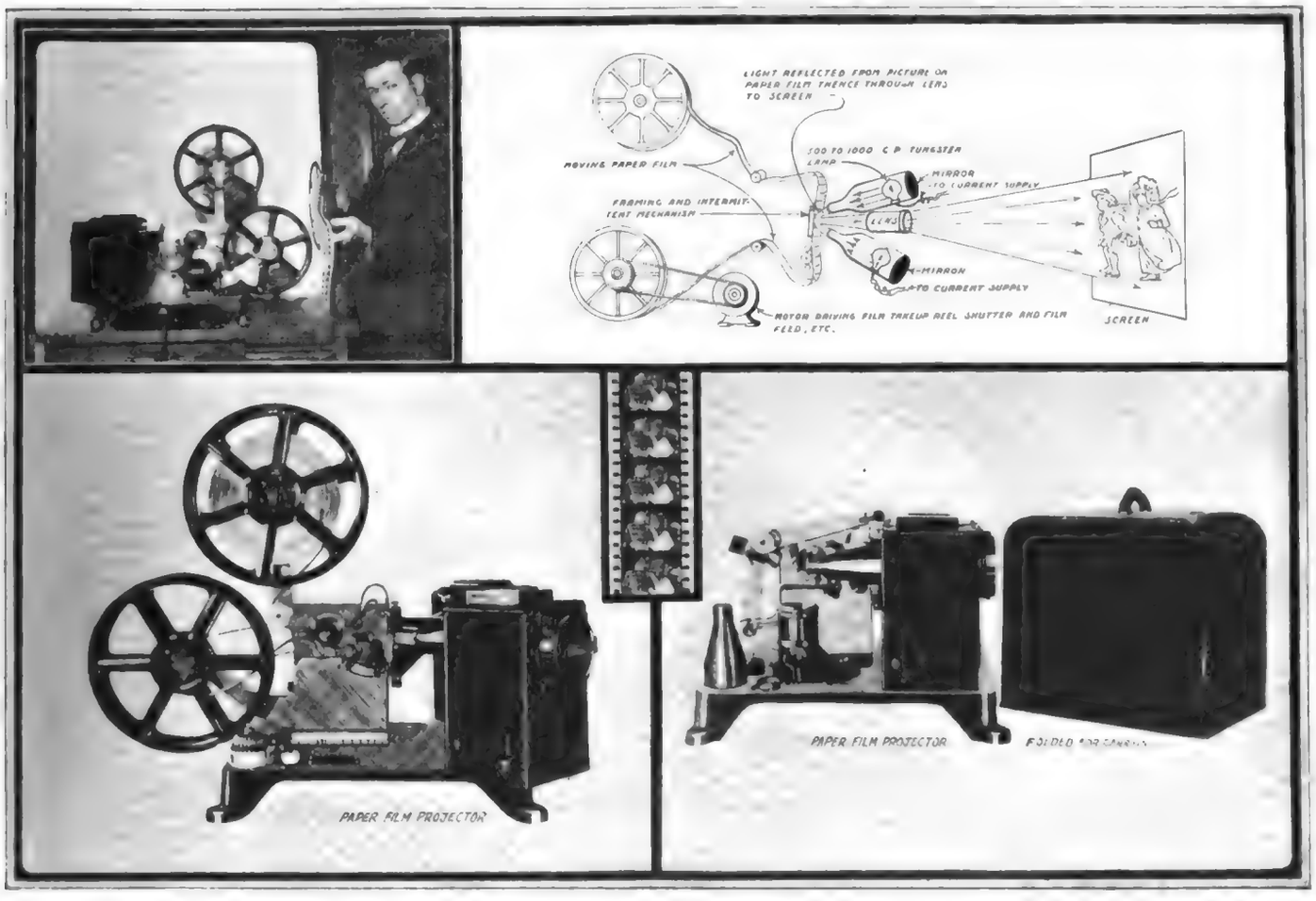
Want More Information?

IF you want additional information concerning any of the subjects illustrated and described in this number of SCIENCE AND INVENTION, we shall be glad to give you other data we have at our command if you will send 50c for such special data. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and state exactly in a few words just what it is you desire further information on. We have the original manuscripts and drawings of many of these articles in our files and can furnish much additional data in most cases. Send stamped and self-addressed envelope, together with 50c. remittance in stamps, money order or certified check.

Address all inquiries of this nature to INFORMATION EDITOR, c/o Science and Invention, 53 Park Place, New York City.

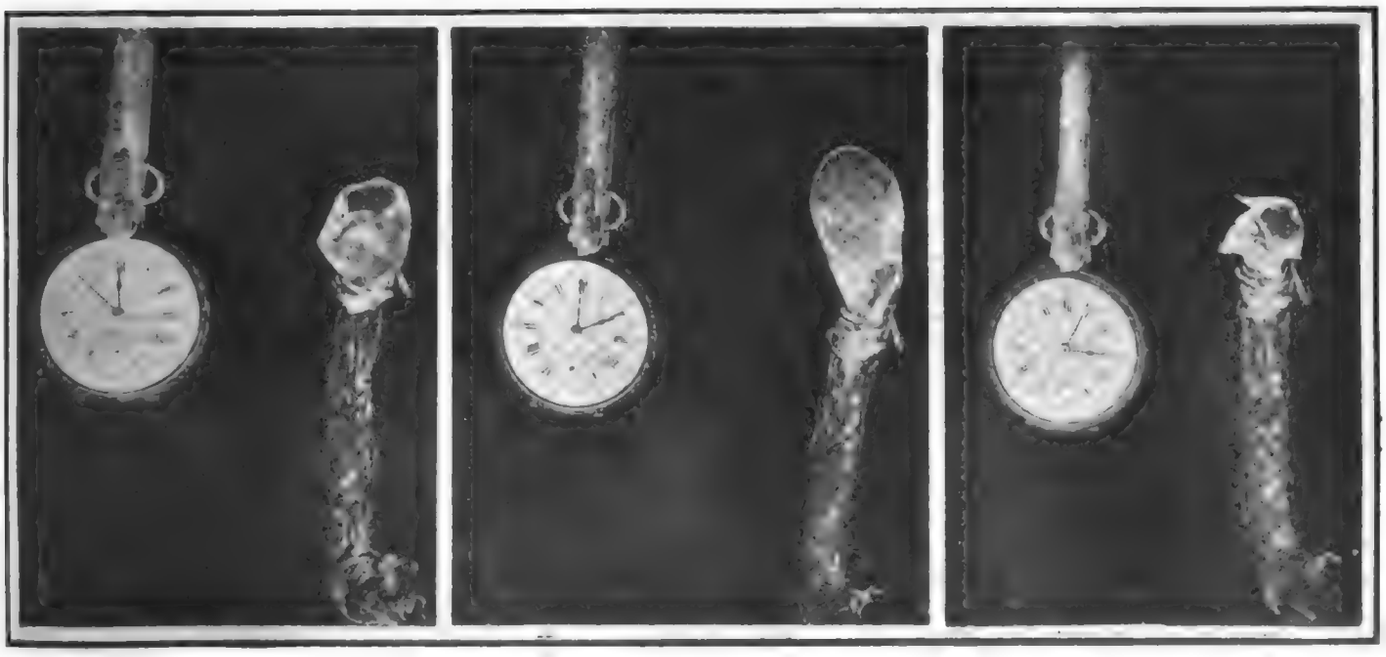
Paper "Film" Movies a Success

By ERIC A. DIME


LIGHT REFLECTED FROM PICTURE ON PAPER FILM THENCE THROUGH LENS TO SCREEN
MOVING PAPER FILM
500 TO 1000 C. P. TUNGSTEN LAMP
MIRROR
TO CURRENT SUPPLY
FRAMING AND INTERMITTENT MECHANISM
LENS
MIRROR
TO CURRENT SUPPLY
MOTOR DRIVING FILM TAKE-UP REEL SHUTTER AND FILM FEED, ETC.
SCREEN
PAPER FILM PROJECTOR
PAPER FILM PROJECTOR

Paper Movie "Films" Are the Latest. The Upper Left-Hand Photograph Shows the Inventor With One of His Projecting Machines Employing Paper "Film" Movies. The Diagram at the Top Shows How Powerful Incandescent Lamps Supply the Light for the Projector. Light is Reflected From the Opaque Paper "Film" and Then Passes Through a Powerful Lens Onto the Screen. A Specimen From One of the Paper Movies is Shown in the Center.

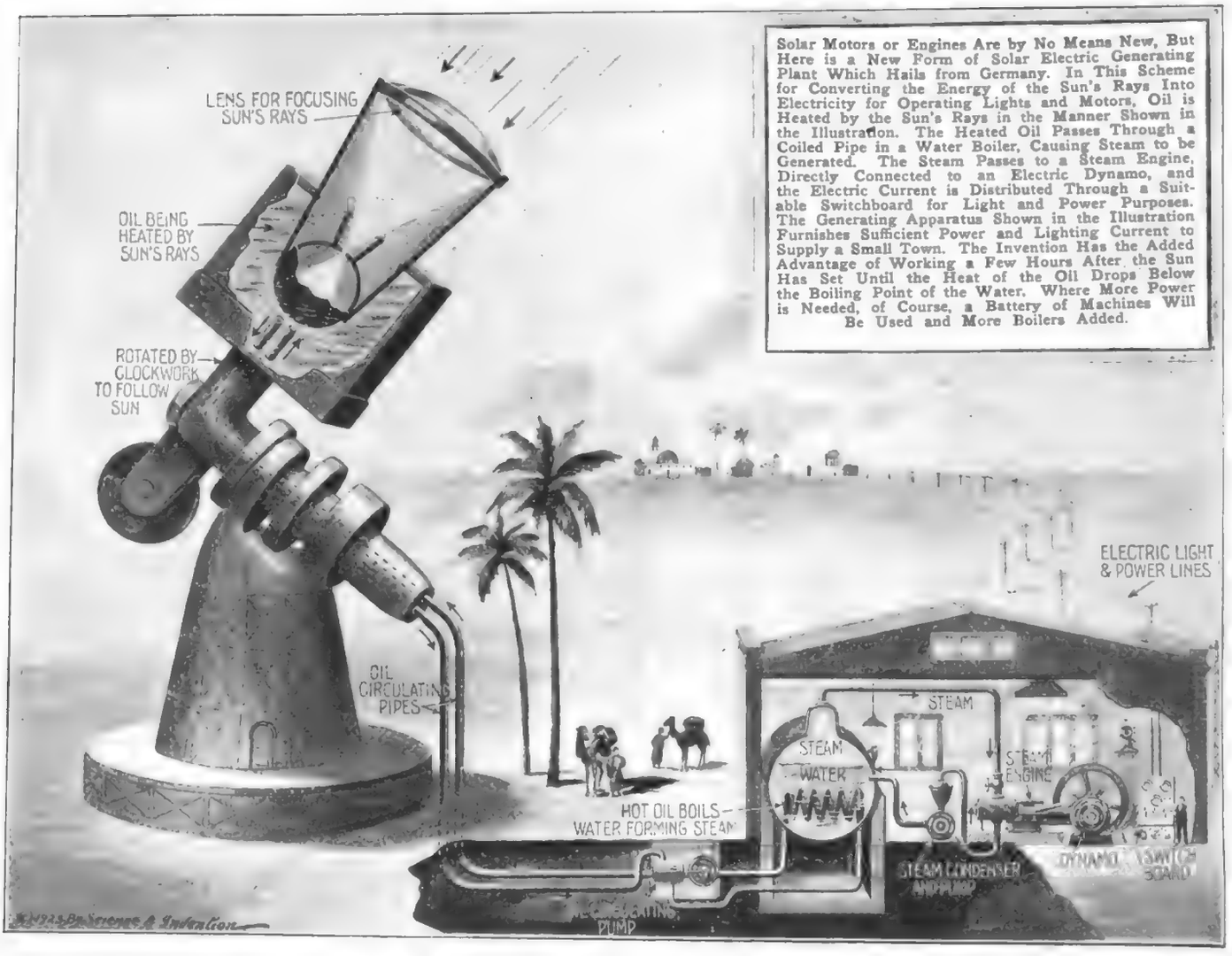
The Power of Sap



The Power of Sap is Vividly Demonstrated by the Three Photos Above Which Were Taken By S. L. Bastin of England. A Piece of Cloth Was Tied Over the End of the Cut Stalk of a Growing Plant. The Watch Shows Time Required, Three Hours and Twelve Minutes, For the Sap to Burst the Bag.

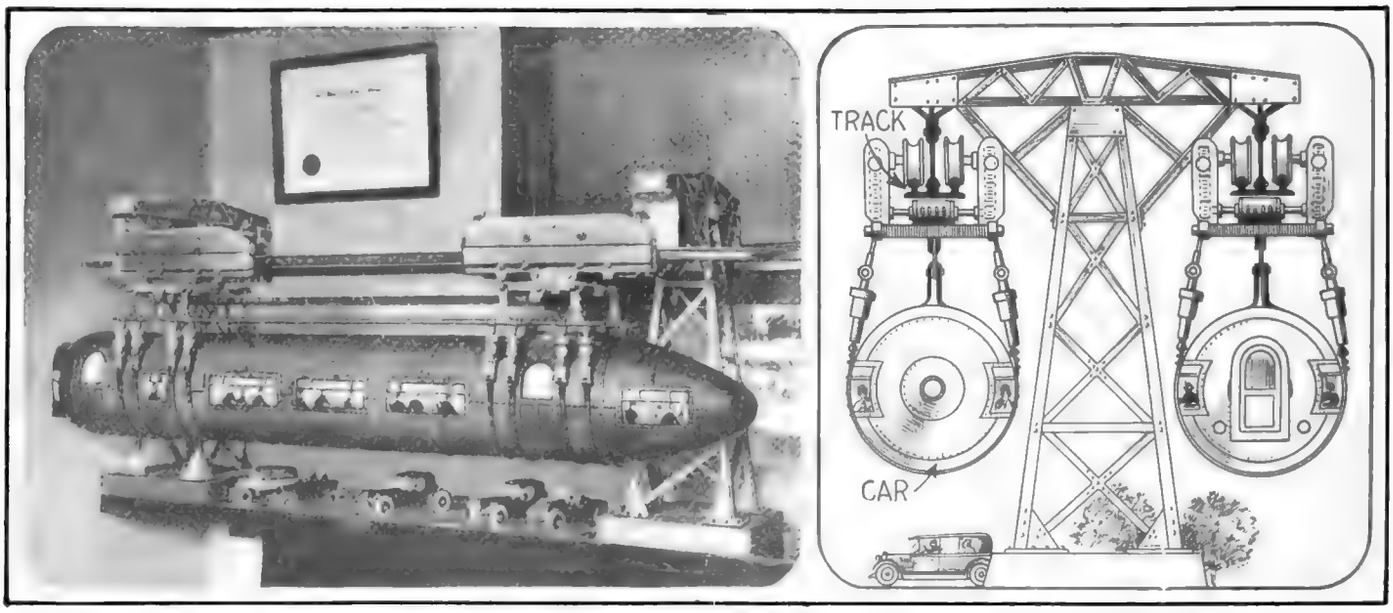
Electricity From the Sun

By Dr. H. BECHER



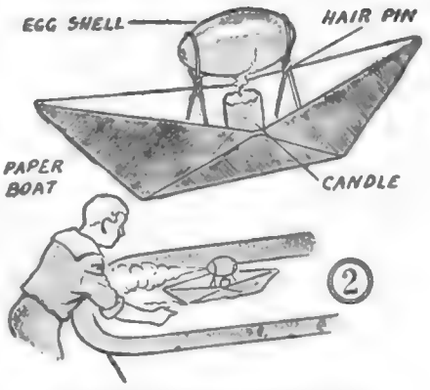
Solar Motors or Engines Are by No Means New, But Here is a New Form of Solar Electric Generating Plant Which Hails from Germany. In This Scheme for Converting the Energy of the Sun's Rays Into Electricity for Operating Lights and Motors, Oil is Heated by the Sun's Rays in the Manner Shown in the Illustration. The Heated Oil Passes Through a Coiled Pipe in a Water Boiler, Causing Steam to be Generated. The Steam Passes to a Steam Engine, Directly Connected to an Electric Dynamo, and the Electric Current is Distributed Through a Suitable Switchboard for Light and Power Purposes. The Generating Apparatus Shown in the Illustration Furnishes Sufficient Power and Lighting Current to Supply a Small Town. The Invention Has the Added Advantage of Working a Few Hours After the Sun Has Set Until the Heat of the Oil Drops Below the Boiling Point of the Water. Where More Power is Needed, of Course, a Battery of Machines Will Be Used and More Boilers Added.

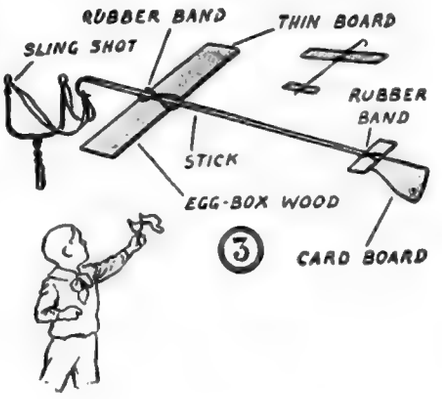
New Suspended Electric Railway



This Model of a Suspended Overhead Street Railway with Torpedo Shaped Cars Was Constructed by Its Inventor, Fletcher E. Felts, of Los Angeles, Calif., and It Has Been Approved and Recommended by the Police Department of That City, Reports State. The Cross-Sectional View of the Suspension Railway Shown at the Right Indicates How the Electric Motors Drive the Propelling Wheels Through Gears, the Suspension Wheels Being Also the Driving Wheels. The Main Idea is to Give Greater Street Space for Motor Cars.

Toy Contest—$100.00 in Prizes





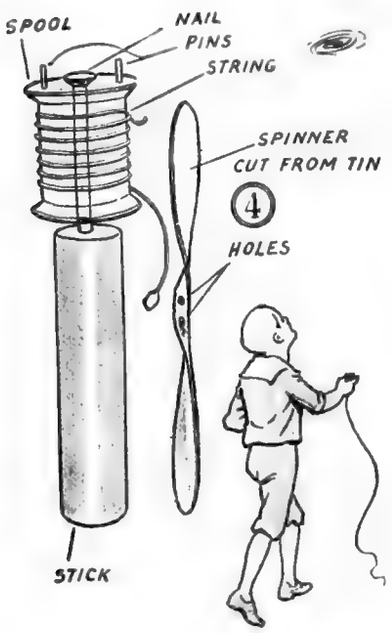
$100.00 IN PRIZES

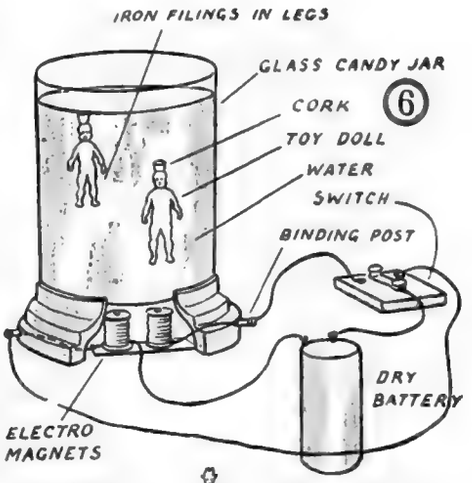
IN an effort to help young Americans build their own toys, we are offering $100.00 in prizes for the most instructive toys submitted to this contest. Toys on the style of those indicated on this page are acceptable, but those which require expensive machines and unusual figures, will not be considered. We desire simple toys made of wood, paper, strings, magnets, glass, rubber bands, bent wire, clockworks and toy electric motors—yet toys which have some educative value.

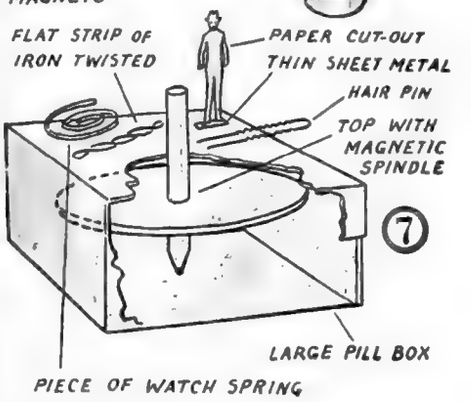
As shown on this page 1 is a toy boat, made of two pieces of wood and a rubber band. 2—Is an egg shell boat. The steam generated causes the paper boat to move forward. 3—Is a small glider propelled by a rubber band. 4—Is an aerial spinner. 5—is a radio elephant propelled out of the box by clapping the hands. The circuit to the electro-magnets is maintained by a small weight which bridges two contacts. Current passing through the coils of the electro-magnets holds a sheet iron plate against them. A sound vibration causes the side of the box to tremble, breaks the contact and propels the elephant out of the box. 6—Are toy dolls containing iron filings in their legs and a cork head. Magnets beneath the base cause them to bob up and down. 7—Is a top with a magnetic spindle. 8—Are pith ball figures mounted in a box beneath a glass plate. Rubbing the glass plate causes them to bounce up and down. In event of ties for any of the awards, participants so tying will be given prizes tied for. Participants are not limited as to the number of entries. A sketch and a 100-word article describing the device are all that is necessary. Models should preferably be submitted. This contest closes in New York, midnight, November 10th., and all articles, manuscripts, and models should be in our hands by that time.

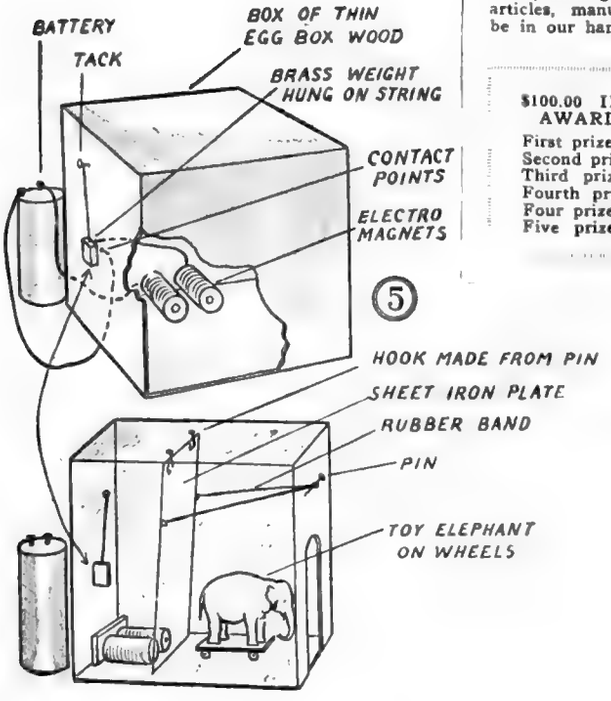
$100.00 IN PRIZES WILL BE AWARDED AS FOLLOWS:

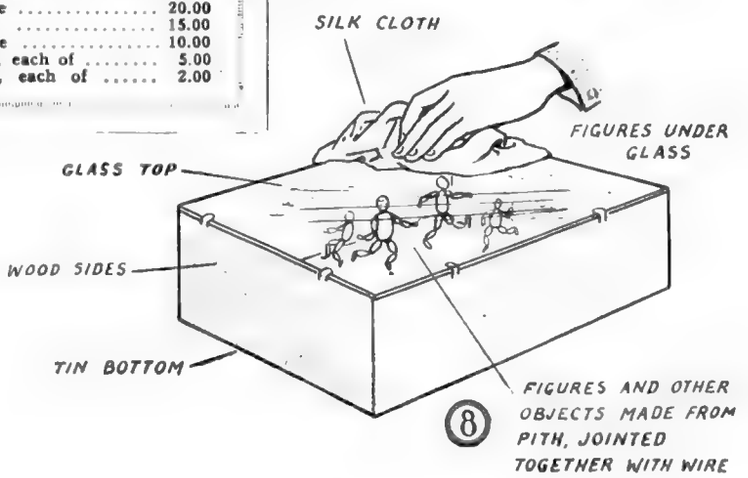
First prize	$25.00
Second prize	20.00
Third prize	15.00
Fourth prize	10.00
Four prizes, each of	5.00
Five prizes, each of	2.00











Making Shot

By ROBERT H. MOULTON

Upper Left: The Sieve From Which a Shower of Lead Drops 154 Feet Into the Water. Upper Center: A Cross-Section View of the Shot Tower. Upper Right: An Exterior View of the Shot Tower. Lower Left: Stream of Shot Going To the First Polisher. Lower Right: Series of Revolving Drums With Screens, Through Which the Perfect Shot Pass To Be Sorted Into Their Various Sizes. Conveyers Then Carry Them to the Shipping Room.

Organ Music

HAS charmed myriads of people in every generation. One of the earliest known musical instruments of any consequence from an engineering point of view, was, the organ. Its music has exercised a powerful influence down through the ages, and it is with great pleasure we present an article on the first organ in the November number. Superb illustrations by the author will accompany it. Mr. C. B. Bunnell, the author, is a keen student of early historical subjects and his pen and ink study of the first organ, described by Hero of Alexandria 280 B. C., is one of the finest pieces of work we have had in many months.

Several of the Other Feature Articles In the November SCIENCE and INVENTION

RAISING BUTTERFLIES AS A BUSINESS, By Dr. Ernest Bade.

THE FIRST ORGAN—AS DESCRIBED BY HERO OF ALEXANDRIA 280 B. C., By Charles Beecher Bunnell.

THE FIRST ELECTRIC FERRY BOAT.

HEARING THROUGH THE TEETH — AN INVENTION WHICH BIDS FAIR TO MAKE THE DEAF HEAR, By H. Gernsback.

WHAT IS A PEARL? By Ismar Ginsberg, B.Sc.Chem.

FORECASTING THE WEATHER, BY THE DIRECTION OF THE WIND, By E. B. "Farmer" Dunn.

HOW TO BUILD A RECTIFIER FOR CHARGING STORAGE BATTERIES. By Dr. Ernest Bade.

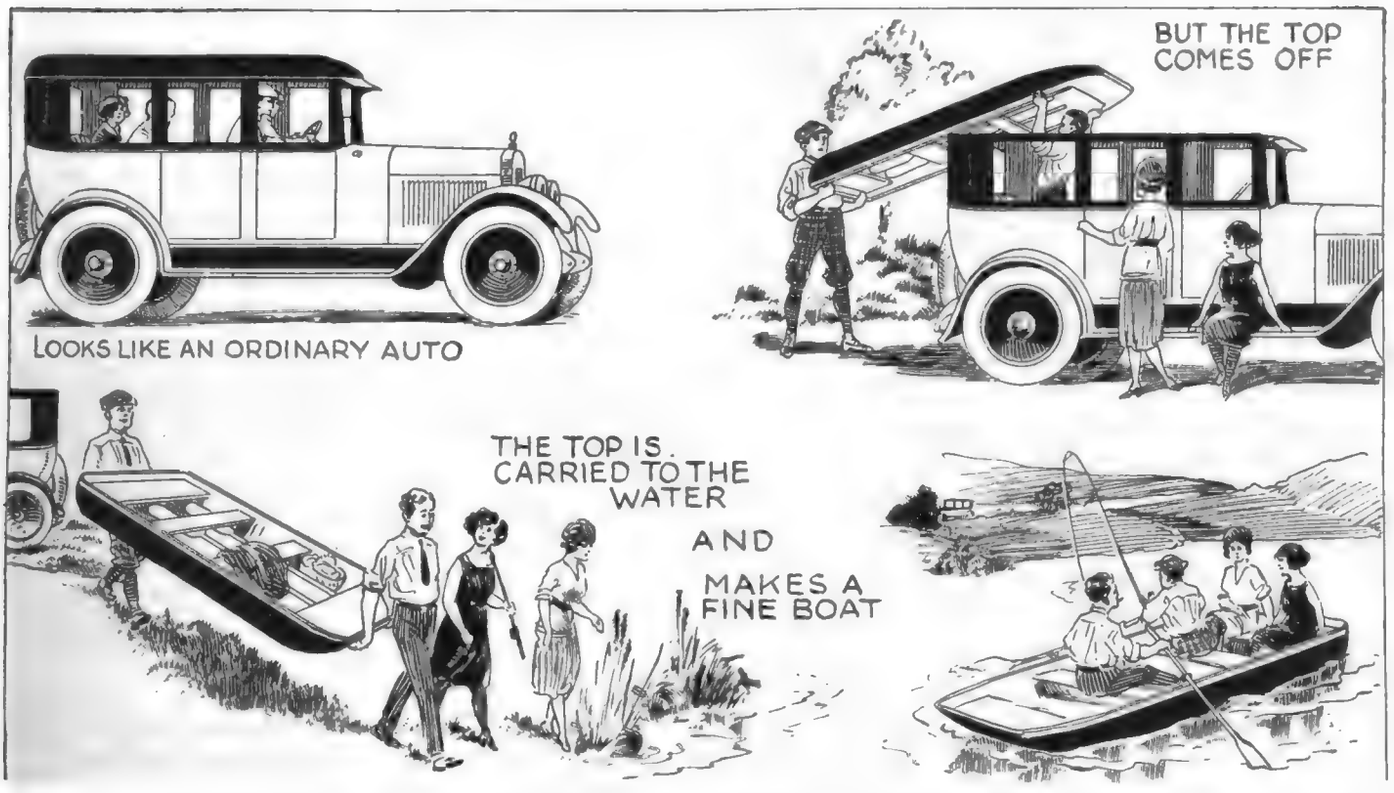
EXPERIMENTS WITH ICELAND SPAR CRYSTALS, By O. Ivan Lee.

THE ROGER'S LOOP AERIAL—FULL DETAILS OF THE NEWEST INVENTION IN RADIO.

AROUND THE UNIVERSE — FIFTH INSTALLMENT, By Ray Cummings.

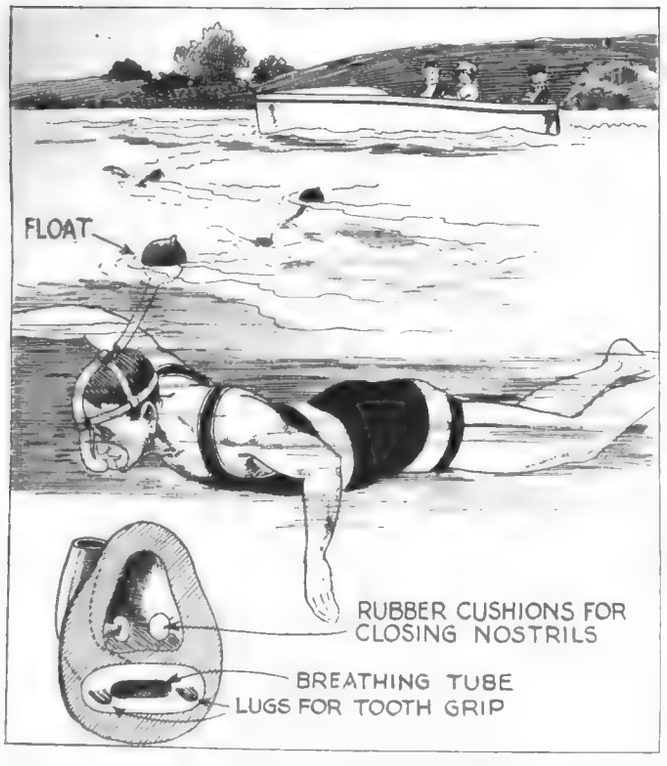
Combination Auto and Boat

By JOSEPH H. KRAUS



Why Go to the Trouble of Hiring a Boat When Out on a Fishing Trip When the Top of Your Automobile Makes a Very Serviceable Skiff? As a Matter of Fact, John A. Cowan of Kansas City, Mo., Has Patented an Automobile of Just Such a Type in Which the Top Comes Off. It May Then Be Carried Down to the Water, the Oars Removed and a Pleasurable Boat Ride May Be Experienced. Of Course if it Should Rain While the Rowers Are on the Lake, the Interior of the Automobile Would Get Wet, But Who Wants to Be in an Open Boat While it is Raining, So the Cover Goes Back in Place.

Air for Swimmers

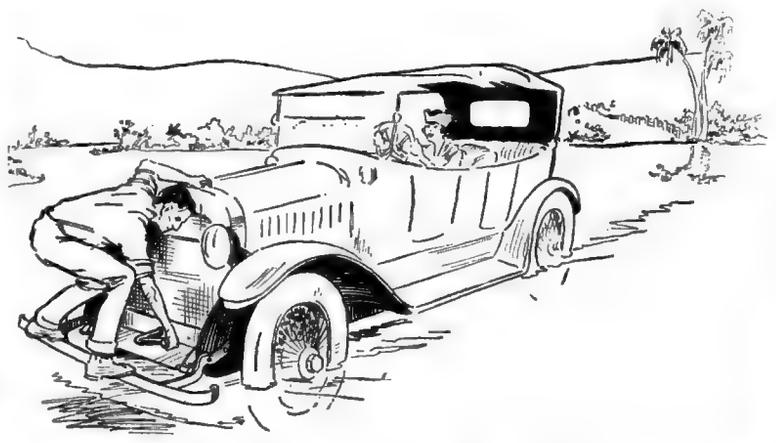


For Teaching Swimmers the Crawl Stroke and Insuring Correct Breathing, the Floating Air Buoys Shown Above, Communicating With the Swimmer's Mouth and Nose By Means of a Rubber Hose, Are Found Very Serviceable. The Swimmer Need Not Raise His Head Above the Surface of the Water at Any Time During a Race. The System is Patented by William S. Feinberg, of Chicago, Ill.

Auto Safety Light

An Ingenious American Inventor, George C. Strong, of Norfolk, Va., Has Patented An Automobile Safety Light Which Attaches Beneath the Left Hand Front Mudguard of An Automobile. This Prevents a Driver Traveling in the Opposite Direction from Mistaking the Position of the Forward Wheel, Thus Preventing Many Accidents.

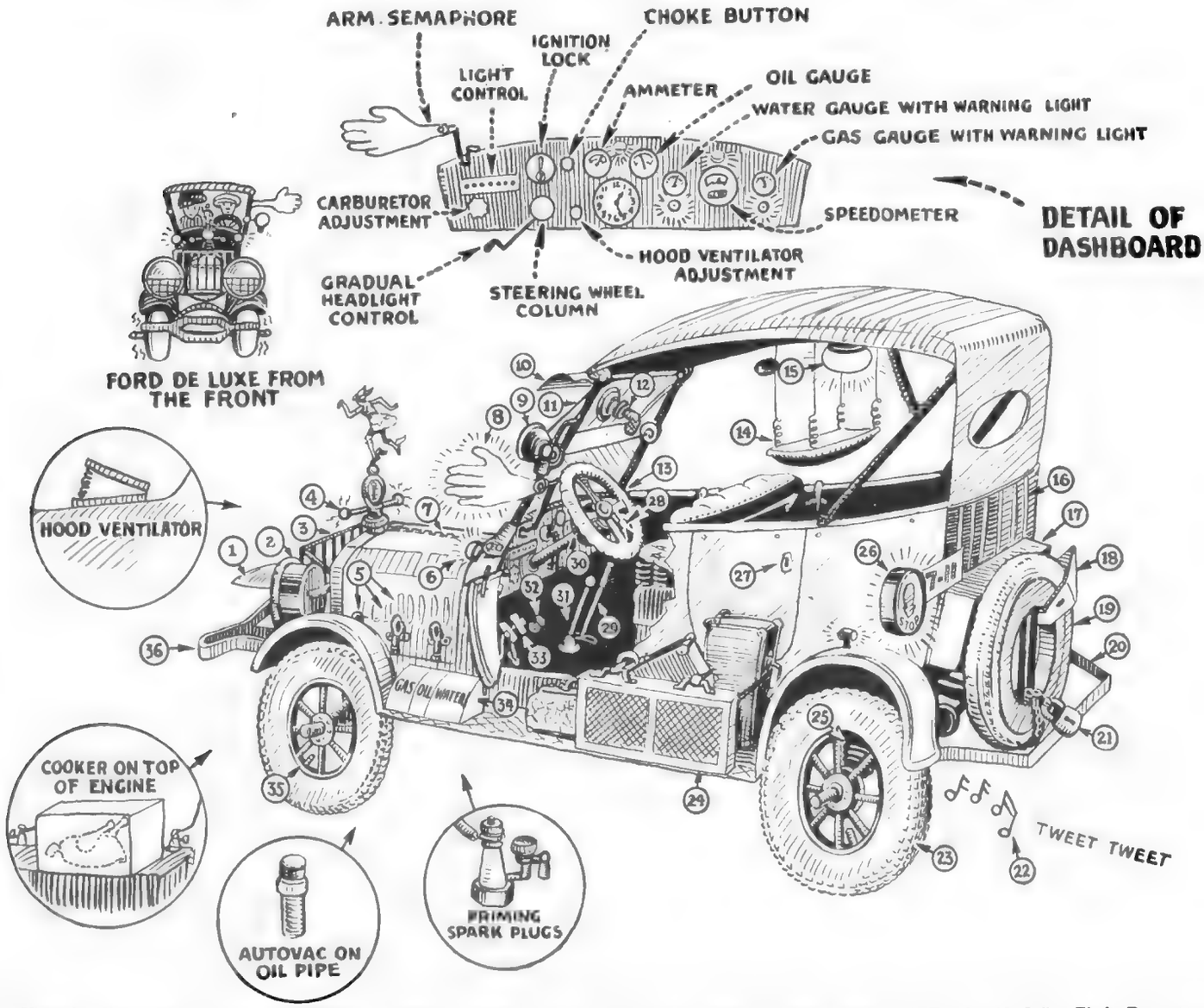
Two Valuable Motor Hints



By Removing All the Spark Plugs from the Engine, Which Was Rendered Inoperative by the Flooding of the Carburetor While Crossing a Stream in Porto Rico, Dr. T. O'Conor Sloane Was Enabled to Turn the Crank and Propel the Car Out of the Stream; the Gear Shift Was Placed in "High." After the Car Had Been "Cranked" Out of the River, the Spark Plugs Were Replaced, the Water Removed from the Carburetor, and the Journey Resumed.

Here is Another Trick Once Used by Dr. T. O'Conor Sloane to Start an Engine Which is Worth Knowing. Place the Gear Shift in "High" and Jack Up One Rear Wheel; Place the Second Jack Under One of the Tire Rim Bolts Which Gives Enough Pressure for Turning the Wheel.

If A "Ford" Used All Accessories!



1 Visor for Headlights; 2 Barrel Headlights; 3 Radiator Shield; 4 Motometer, Electrically Lighted, Surmounted by Figure of Mercury; 5 Spring Hood Clamps; 6 Hood Lights; 7 Special Carburetor; 8 Arm Semaphore; 9 Combination Spot and Trouble Light with Mirror Back; 10 Sun Visor; 11 Slanted Windshield; 12 Spot Light, Trained from Behind Windshield; 13 Electrically Heated Steering Wheel; 14 Baby Carrier; 15 Dome Light in Tonneau; 16 Brass Strips to Protect Paint; 17 Trunk; 18 Spike Theft Preventer. 19 Spare Tire Carrier; 20 Rear Bumper Attached to Mud Guards; 21 Spare Tire Lock; 22 Exhaust Whistle; 23 Oversize Tires; 24 Luggage Carrier; 25 Shock Absorbers; 26 Wright Stop Signal; 27 Door Locks; 28 Watch on Steering Wheel; 29 Brake; 30 Steering Column Lock; 31 Gear Shift Lever; 32 Accelerator; 33 Non-Slip Pedals; 34 Emergency Gas, Water and Oil; 35 Visible Tire Gauge; 36 Front Bumper—and They Sell 'Em.

Magic For Everybody

By PROF. JOSEPH DUNNINGER.

NO. 7 OF A SERIES

The Hypnotic Stunt (1) is Performed with Apparatus Shown. The Rod Slipped Through Tube, Operated by Windlass Beneath Stage, is Attached to the Lady's Legs. (2) To Read the Deck from the Back Use Small Mirror and Wax. (3) The Mystic Wineglass Fills as Soon as Emptied if Bulb is Pressed. (4) The Handkerchiefs Knot When Thrown, with the Aid of a Rubber Band. Operator Snaps Band Over Corners When He Drops Them.

Popular Astronomy

By ISABEL M. LEWIS, M.A.

Of the U. S. Naval Observatory

THE constellations most favorably located for observation in October, are:

Cassiopeia and Cepheus near the meridian due north.

Pisces, Andromeda and Pegasus in the east.

Cygnus and Lyra in the west.

Delphinus and Aquila in the southwest.

Capricornus and Aquarius on the meridian due south.

The far southern constellation of Piscis Australis is visible near the southern horizon and contains the briliant, first-magnitude star Formalhaut.

NOW SETTING WEST

Ophiuchus and Serpens, Boötes, Corona Borealis and Hercules are now setting in the west, they will not be visible in the evening again until spring or early summer.

Constellations now rising are:

Perseus, the Pleiades, and Auriga in the northeast; Cetus in the east. These groups will be better placed for observation next month.

THE MILKY WAY

The Milky Way is now magnificently in view on clear, dark nights when the moon is absent. It stretches across the heavens in an irregular belt from the northeastern to the western horizon passing through the constellations of Auriga, Perseus, Cassiopeia and Cephus to Cygnus, where it divides into two streams, one passing through Serpens and Ophiuchus to the horizon, and the other through the small constellation of Sagitta. The Arrow, and Aquila, The Eagle.

The Milky Way is particularly rich in stars and nebulæ in Perseus and Cygnus. Even a field glass will reveal some of the wonderful richness of the star fields in these regions.

FIRST MAGNITUDE STARS

Among the stars of the first magnitude visible in October are: Deneb, or Alpha Cygni, a white star in Cygnus now near the zenith in our latitude (40° North). Also *Fomalhaut*, far south, east of the meridian, a beautiful white star. One of the nearer stars, about twenty-five light years from the earth, is *Altair*, in Aquila, in the southwest. Alpha Centauri, Sirius and Procyon are nearer [illegible] about 16 light years distant. *Vega*, in Lyra, now west of the meridian near the zenith is a magnificent blue-white star easily identified by its two faint, attendant stars that form a small triangle with it. Vega shares with Capella the honor of being the brightest star north of the celestial equator. It is about 40 light years from the earth.

Capella in Auriga, a yellow star now rising in the northeast, is equal in brightness to Vega. It is of the same type as our own sun and about 33 light years distant.

No planets are visible this month at this time.

OF SPECIAL INTEREST

Among the objects of special interest visible at this time is *the Great Square in Pegasus*. This huge square is formed by three bright stars in Pegasus and a fourth in Andromeda. It is one of the best-known configurations in the heavens, as distinctive in form and as easily recognized as the Big Dipper. We associate it always with the first clear, frosty evenings of early fall.

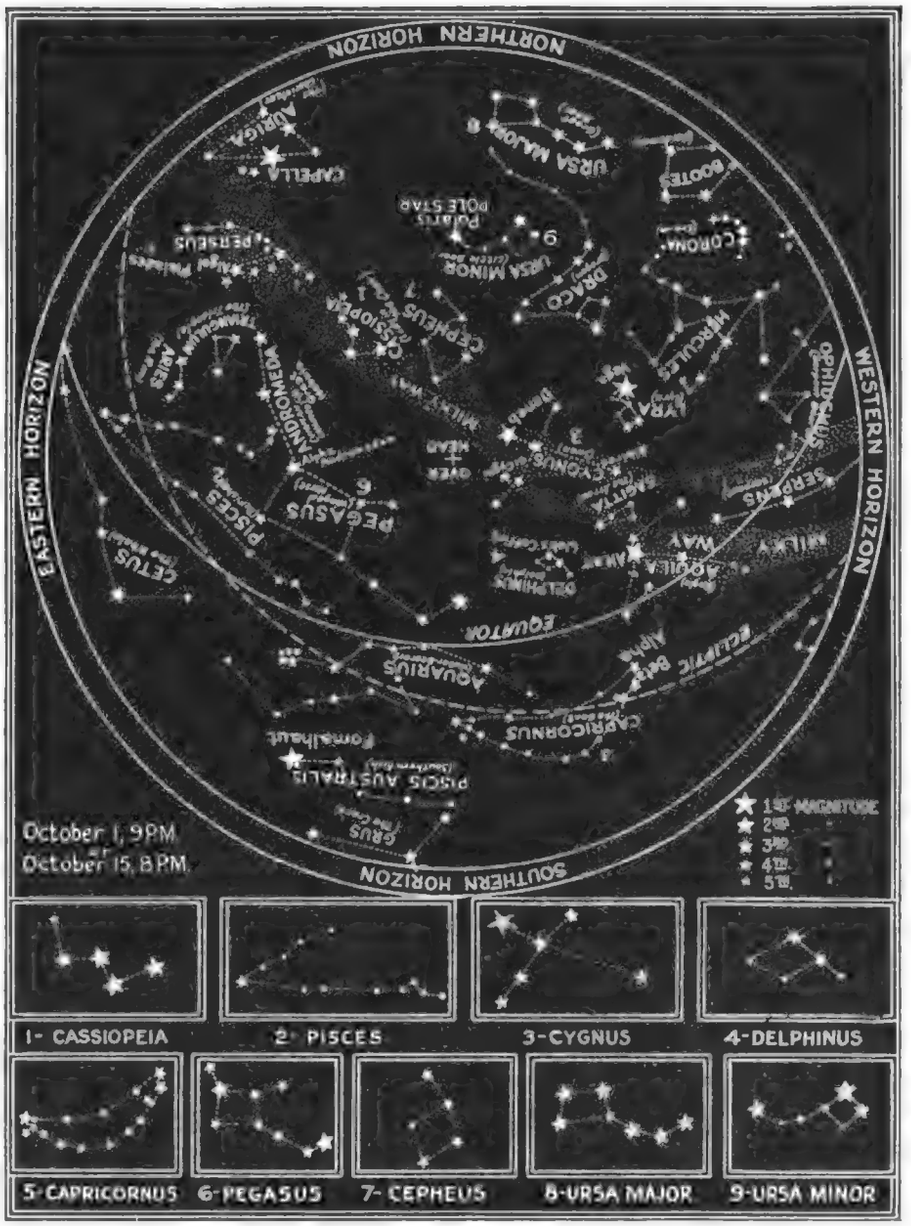
The Northern Cross in Cygnus, with Deneb, the first-magnitude star at the head of the cross, with Albireo—visible as a beautiful blue and gold double star in small telescopes—at its foot is visible this month. It is a beautiful configuration considered by some to be equal in splendor to the far-famed Southern Cross.

MOST DISTANT STAR

"Job's Coffin" is a very distinctive little diamond-shaped group of stars in Delphinus. In this constellation is located the most distant known object in the heavens, a faint globular star cluster distant 220,000 light years from the earth.

Alpha in the constellation of Capricornus, The Sea-Goat, is one of the few stars in the heavens that appears double to the naked eye. It can be separated even though it is somewhat unfavorably placed for observation in our latitudes. The star Beta which is a little brighter than Alpha lies just to the south of it.

The *Great Nebula in Andromeda* is to be found in the position indicated on the chart. Faintly visible to the naked eye as a small, hazy patch of light, it is a magnificent object as shown on photographs taken with the aid of powerful telescopes. Its distance is not definitely known but it is one of the nearer spiral nebulas.

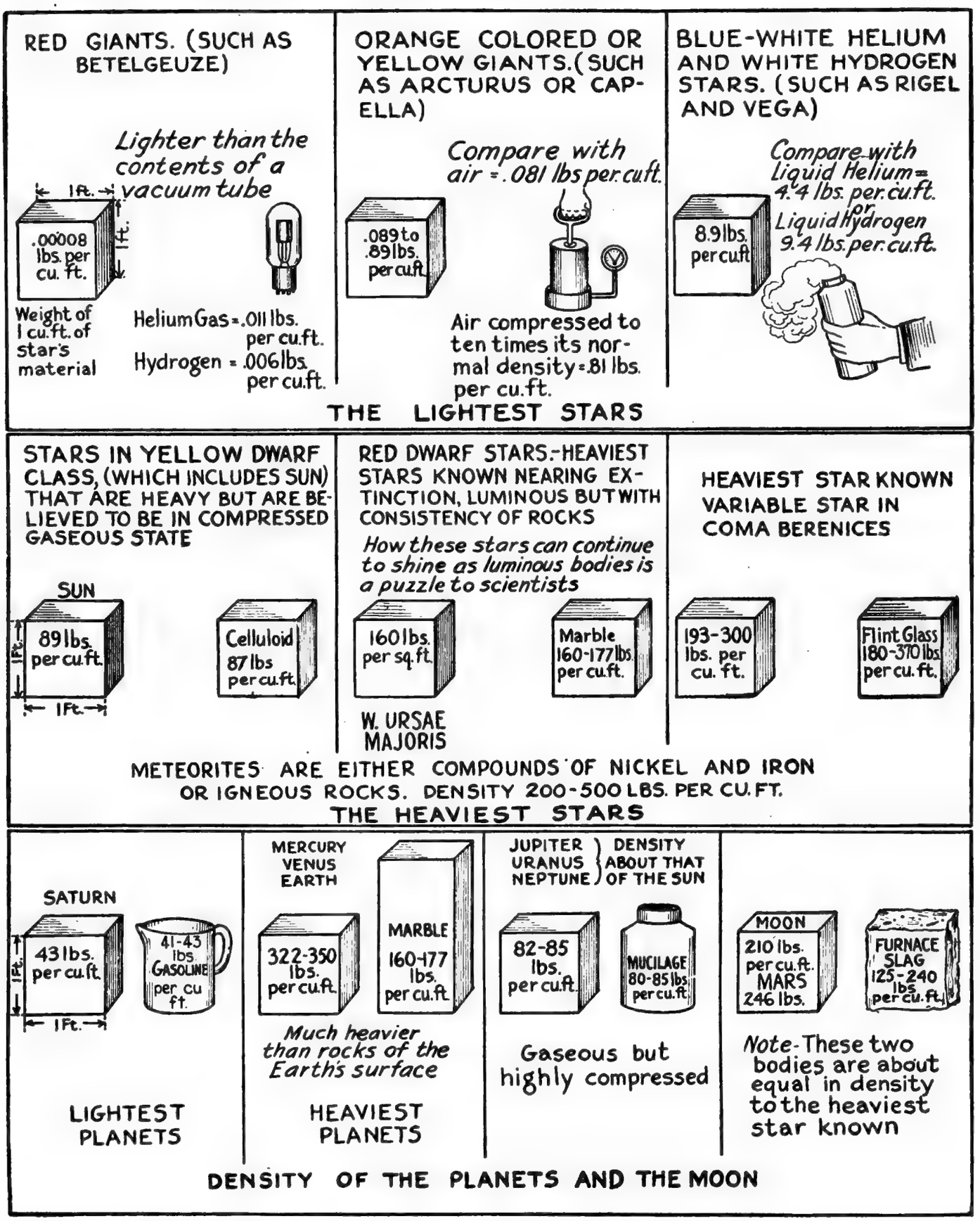


Above is Shown a Map of the Heavens for October. The Constellations Will Have the Exact Locations in the Sky as Shown on the Map at 9 P. M., October 1, or 8. P. M., October 15. To Use the Map, Hold It in an Inverted Position Over the Head with the Direction Indicated on the Map Coinciding with the Real Direction; That is, with the Top of the Map Toward the North. The Zenith is the Point Directly Overhead and the Meridian is a Line Running North and South, Passing Through the Zenith and Polaris. Close-up Views of Each of the Larger Constellations Are Reproduced in the Lower Half of the Illustration.

METHODS OF STUDY

In studying the constellations with the aid of the chart shown on this page, do not pick those configurations lying close to the horizon. If trees and buildings do not obstruct the view of them, the haze and fog that always fill the lower part of the atmosphere around the horizon will prohibit a clear view. None of the planets are to be seen to advantage this month at the hours mentioned in the chart. When they do appear, however, they will be seen somewhere near the path of the ecliptic. They never get more than a few degrees away from it to one side or the other. When seen they will be in one of the zodiac constellations.

Comparison of Density of Celestial Bodies with Familiar Substances

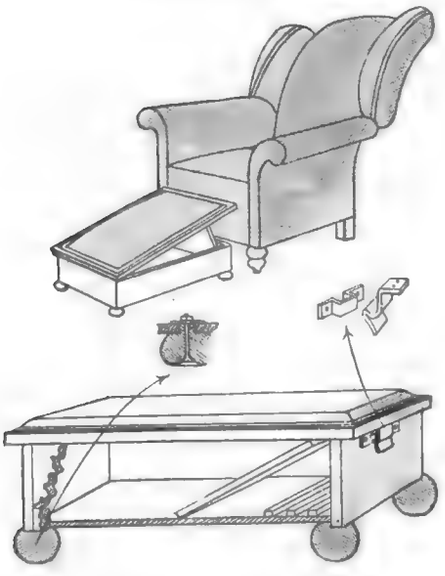

RED GIANTS. (SUCH AS BETELGEUZE)
Lighter than the contents of a vacuum tube
1 Ft.
.00008 lbs. per cu. ft.
Weight of 1 cu.ft. of star's material
Helium Gas = .011 lbs. per cu.ft.
Hydrogen = .006 lbs. per cu.ft.
ORANGE COLORED OR YELLOW GIANTS. (SUCH AS ARCTURUS OR CAPELLA)
Compare with air = .081 lbs per cu.ft.
.089 to .89 lbs. per cu.ft.
Air compressed to ten times its normal density = .81 lbs. per cu.ft.
BLUE-WHITE HELIUM AND WHITE HYDROGEN STARS. (SUCH AS RIGEL AND VEGA)
Compare with Liquid Helium = 4.4 lbs. per cu.ft. or Liquid Hydrogen 9.4 lbs. per cu.ft.
8.9 lbs. per cu.ft.
THE LIGHTEST STARS
STARS IN YELLOW DWARF CLASS, (WHICH INCLUDES SUN) THAT ARE HEAVY BUT ARE BELIEVED TO BE IN COMPRESSED GASEOUS STATE
SUN
89 lbs. per cu.ft.
1 Ft.
1 Ft.
Celluloid 87 lbs per cu.ft.
RED DWARF STARS:-HEAVIEST STARS KNOWN NEARING EXTINCTION, LUMINOUS BUT WITH CONSISTENCY OF ROCKS
How these stars can continue to shine as luminous bodies is a puzzle to scientists
1601 lbs. per sq.ft.
W. URSAE MAJORIS
Marble 160-177 lbs. per cu.ft.
HEAVIEST STAR KNOWN VARIABLE STAR IN COMA BERENICES
193-300 lbs. per cu. ft.
Flint Glass 180-370 lbs. per cu. ft.
METEORITES ARE EITHER COMPOUNDS OF NICKEL AND IRON OR IGNEOUS ROCKS. DENSITY 200-500 LBS. PER CU. FT.
THE HEAVIEST STARS
SATURN
43 lbs. per cu.ft.
1 Ft.
1 Ft.
41-43 lbs. GASOLINE per cu ft.
LIGHTEST PLANETS
MERCURY VENUS EARTH
322-350 lbs. per cu.ft.
MARBLE 160-177 lbs. per cu.ft.
Much heavier than rocks of the Earth's surface
HEAVIEST PLANETS
JUPITER URANUS NEPTUNE } DENSITY ABOUT THAT OF THE SUN
82-85 lbs. per cu.ft.
MUCILAGE 80-85 lbs. per cu.ft.
Gaseous but highly compressed
MOON
210 lbs. per cu.ft.
MARS 246 lbs.
FURNACE SLAG 125-240 lbs. per cu.ft.
Note- These two bodies are about equal in density to the heaviest star known
DENSITY OF THE PLANETS AND THE MOON

The Density of the Heavenly Bodies Can Be Easily Visualized by the Diagrams Shown Above. In Regard to the Heavier Bodies, Whose Density is Indicated in the Center Cut on the Page, It May Be Said That Many Scientists Hold the Theory That the Luminous Stars Generate the Heat Necessary to Keep Them Incandescent by Constant Contraction. These Red Dwarf Stars Have Almost Ceased to Contract. S[illegible] Say.

Home Mechanics

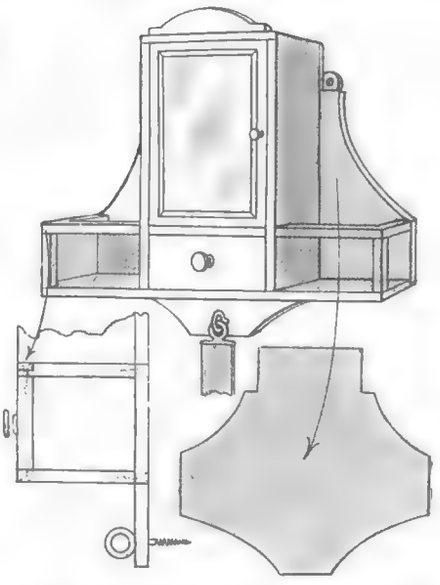
By WILLIAM M. BUTTERFIELD

FOOT STOOL AND LEG REST



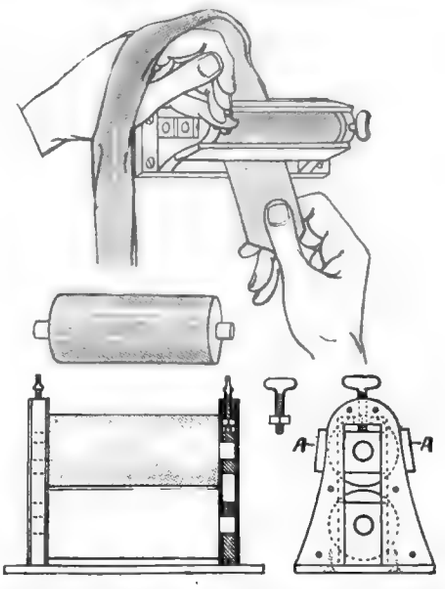
A Welcome Addition to Any Easy Chair in the Form of a Foot Stool May be Very Readily Made as Shown Above and Placed on Rollers or Casters so as to be Easily Moved From Place to Place.

SHAVING CABINET



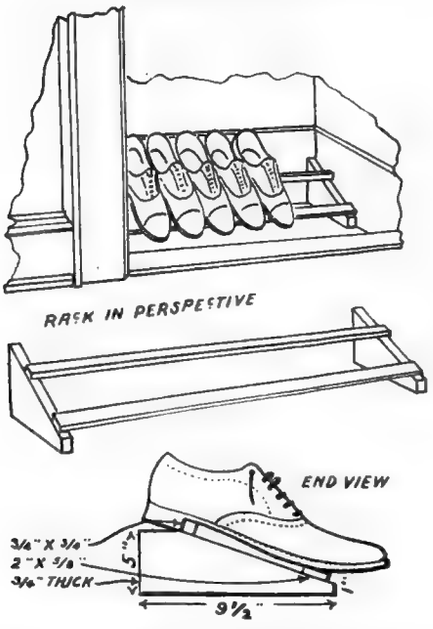
The Handy Shaving Cabinet Which May Be Seen Above Will Hold All the Materials Necessary for a Comfortable Shave. The Mirror in the Door Makes it Unnecessary to Have a Separate Mirror.

PRESS YOUR NECKTIE



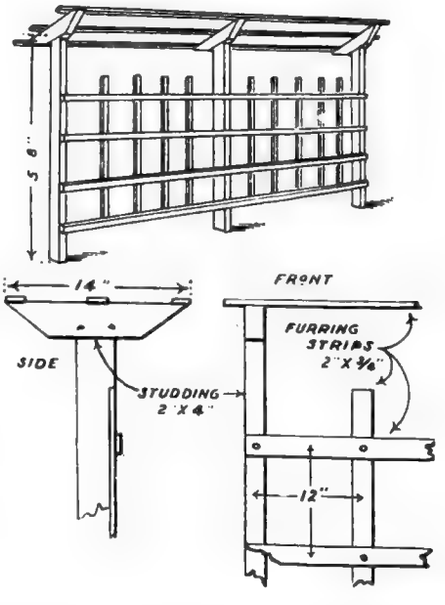
Neckties Which Simply Will Not Stay Pressed Can be Smoothed Out in a Jiffy by Using the Mangle Type Presser Shown Above. The Parts Are Simple, Two Rollers and a Compression Screw.

CLOSET SHOE RACK



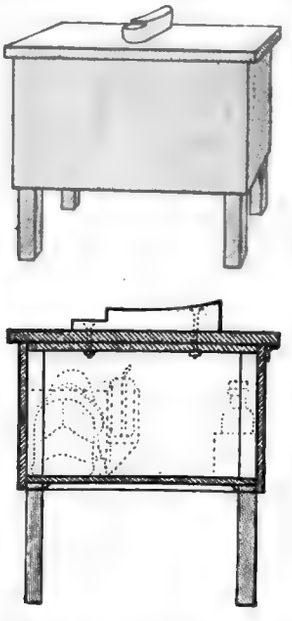
Is Your Domestic Life Ruined Because Your Wife or Sister Can Never Remember Where You Threw Your Shoes? Then Try This Little Rack in Your Closet. It Will Remove the Temptation to Throw Them Behind the Trunk.

ATTRACTIVE FENCE



The Pergola and Lattice Work Fence Shown Above Will Add Greatly to the Value of Your Property. The Plan Gives Structural Details. The Average Cost of the Fence per Eight Foot Section is only $1.25.

YOUR OWN SHINE PARLOR



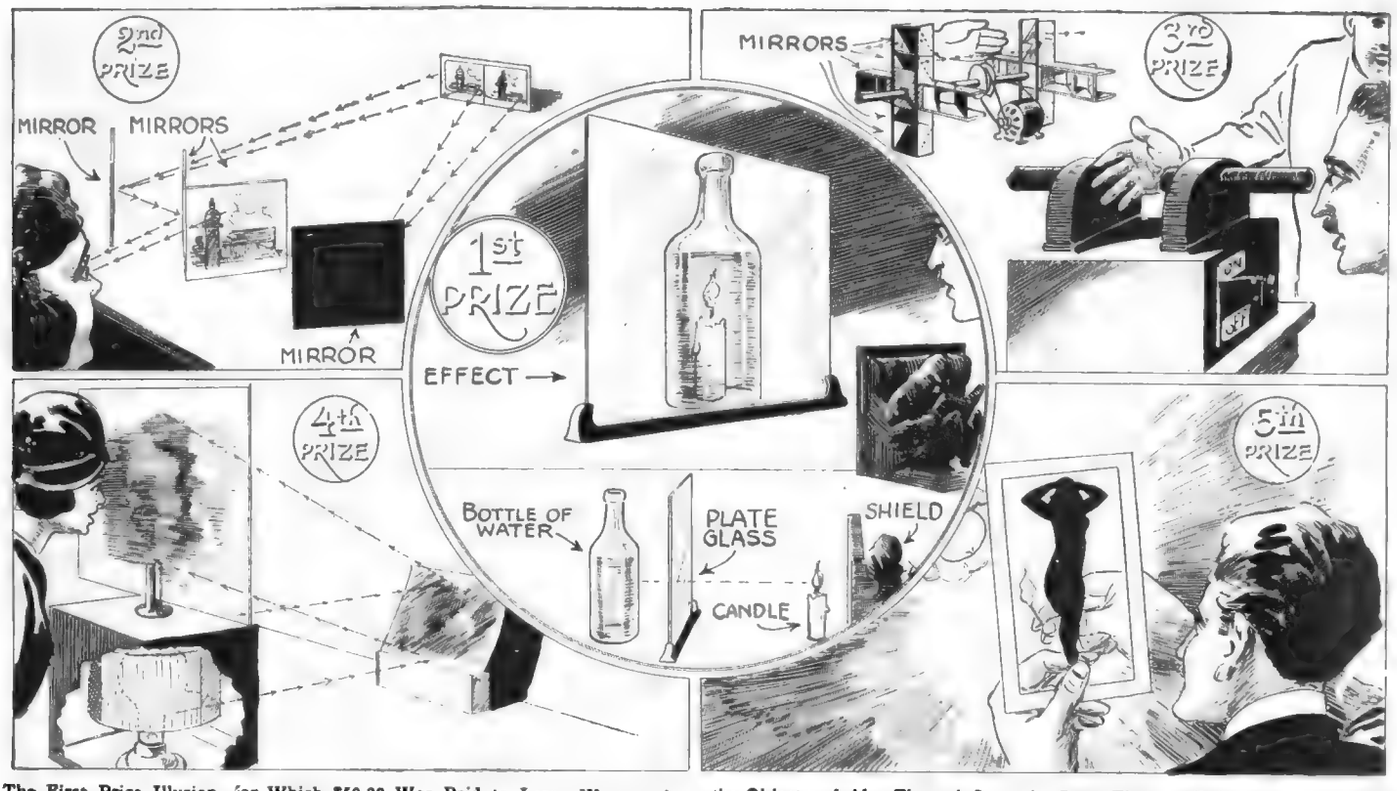
The Little Stand Shown Above Will Beat Tony, the Bootblack, Out of Many a Dime. With the Convenient Footrest on Top and All the Necessary Materials Gathered Below, Most of the Unpleasantness of the Homemade Shine is Extracted.

Single Tube Radio Contest

WE wish to call attention to the special $200.00 prize contest for the best single tube receiving sets, described in detail on page 574. We announced this contest originally in the July number, but owing to the usual summer vacations coupled with the warm weather, our readers apparently have not been very industrious in turning out anything new in radio receiving hook-ups.

We advise all radio fans to read the rules of this contest carefully; and in order to give everyone a chance to win one of the ten prizes in gold, there being two first prizes of $50.00, each in gold, we have extended the closing date of this contest to November 15th. The instrument submitted for test need not be an elaborate one at all so long as it works properly.—THE EDITORS.

Optical Illusion Contest Awards



The First Prize Illusion, for Which $50.00 Was Paid to Leroy Western, is Made by Placing a Bottle Nearly Filled with Water Behind a Small Piece of Plate Glass. In Front of the Glass a Lighted Candle is Placed Behind the Screen So That When the Observer Looks at the Glass the Reflection of the Candle Makes It Seem to Be Burning in the Water.

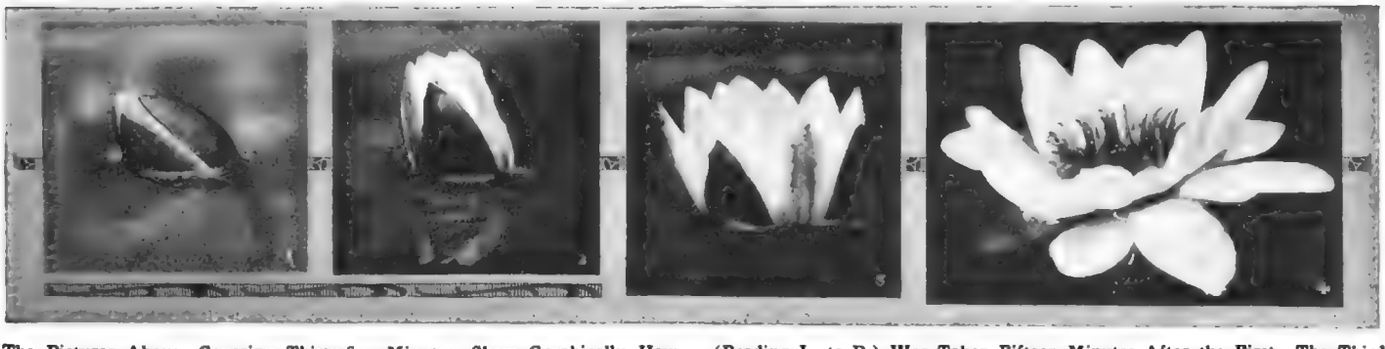
The Second Prize of $20.00 Won by Brent McRae, is a Mirror Stereoscope. The Two Mirrors in the Center Are at an Angle of 45°. The Outside Mirrors Are 3 Inches from the Inner Ones. Regular Stereoscope Pictures May be Used. Others, Two and One-half Inches Square, Will Also Work. The Mirrors and Pictures Must Be Vertical. The Exact Distances and Angles May Be Found by Experimenting.

The Third Prize, of $15.00, Which Went to Esten Moen, is an "X-Ray" Machine. The Mirrors Placed on the Moving Axle, Revolved at About 200 R.P.M. Through the Phenomenon of "Retention of Vision," the Observer Sees the Object and Also Through It at the Same Time. All Apparatus is Placed in the Case Shown.

The Fourth Prize of $10, Which Was Won by G. H. Getz, Consists of a Sheet of Glass Supported on a Box Containing a Regular Light Bulb Which is Fitted with a Rotating Screen Colored so the Colors Fade Into Each Other. The Shade is Constructed on a Light Cardboard Frame with a Top Which is Fluted with Vanes so the Hot Air Will Rotate the Shade. The Light is Reflected Through a Hole in the Back of the Box to the Mirror and Onto the Glass. The Screen is Supported on a Metal Bearing Resting on the Tip of the Bulb.

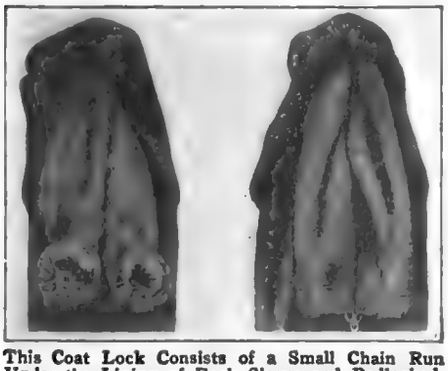
In the Fifth Prize Illustration, for Which $5.00 Was Paid to John Stoneham, the Cardboard Figure, Glued to Thin Gauze Which is Held on a Coardboard Frame, Will Seem to Move If a Light is Swayed from Side to Side Behind It.

How The Water Lily Greets The Sun



The Pictures Above, Covering Thirty-five Minutes, Show Graphically How the Water Lily Opens to the Sun in the Morning. The Second Picture (Reading L. to R.) Was Taken Fifteen Minutes After the First. The Third and Fourth each at Ten-Minute Intervals Follow the Second Picture.

A Lock For Coats



This Coat Lock Consists of a Small Chain Run Under the Lining of Each Sleeve and Padlocked.

THE EDITORS ASK A FAVOR

To our readers:

This is the first issue of the NEW SCIENCE AND INVENTION. It has been created at a cost three times as great as any previous number. In order to put it out the editors have expended a vastly greater effort than ever before.

May we then ask you to voice your approval or disapproval of the NEW SCIENCE AND INVENTION. It is not necessary to sign your name. Just cut this out paste on back of a postal card and mail to the Editor.

I approve your new policy .....

Why I do .....

I do not approve your new policy .....

Why I do not .....

Name .....

Address .....

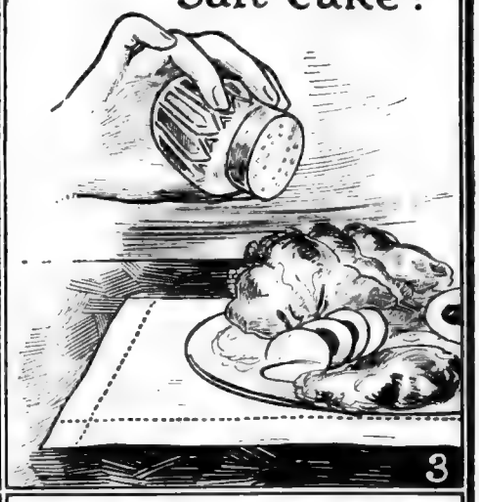
Everyday Chemistry

By RAYMOND B. WAILES

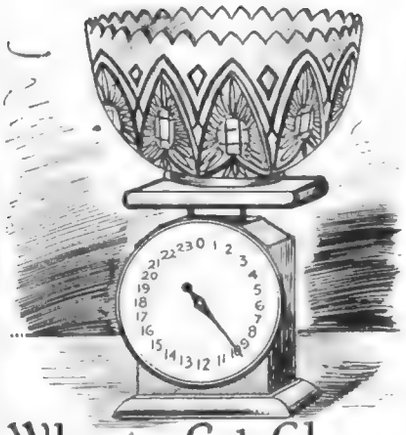
Sooty Pots?
Give the burner more air
1

What are Transparent Soaps?
2

Why does Salt cake?

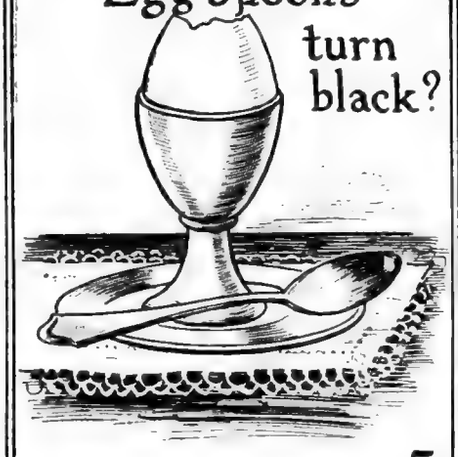


3



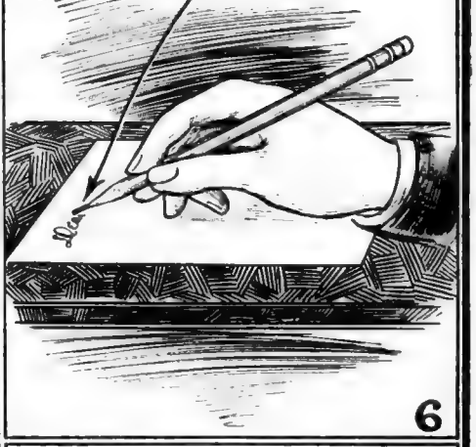
Why is Cut Glass very heavy? 4

Why do Egg Spoons turn black?



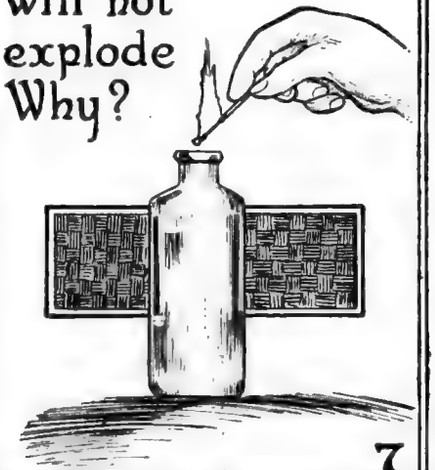
5

Is this Point really Lead?

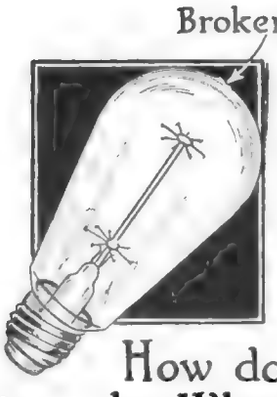


6

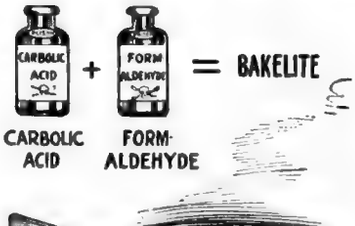
Certain "Cleaners" will not explode Why?

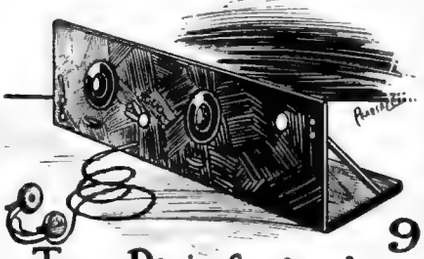


7



8 How does the White Cloud form in Electric Light Bulbs?





9

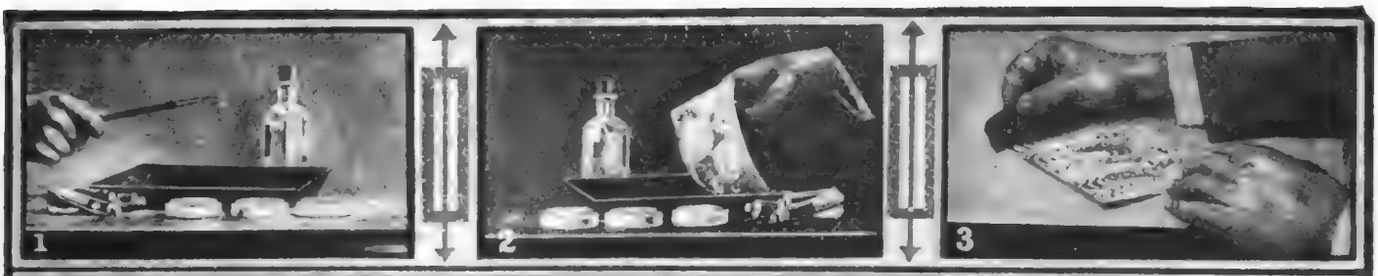
Two Disinfectants make a Radio Panel

The Answers are: (2) Alcohol in Regular Soap Dissolves the Color. (3) Impurities [illegible]lt Cause It to Cake. (4) Cut Glass Contains Lead Silicate. (5) Due to the Sulphur in the Egg. (6) No. Graphite. (7) Carbon Tetrachloride is Non-Combustible. (8) Tungsten Oxide, Formed by Action of Oxygen on Tungsten is White.

THE CONSTRUCTOR

Decorative Effects From Oil

By DR. ERNEST BADE



Surface Tension is Responsible for Dr. E. Bade's Method of Making Decorative Papers Used for Making Photograph Mountings, Lamp Shades, Box Covers, or Other Paper Novelties. Photo Shows Method Used for Spattering the Colors on the Treated Water from Which the Print is Taken. Each Tint Must Have a Separate Container. The Pigment Used is Regular Tube Oil Color Diluted with Turpentine. A Marbling Effect Is Obtained by Drawing a Match Through the Surface.

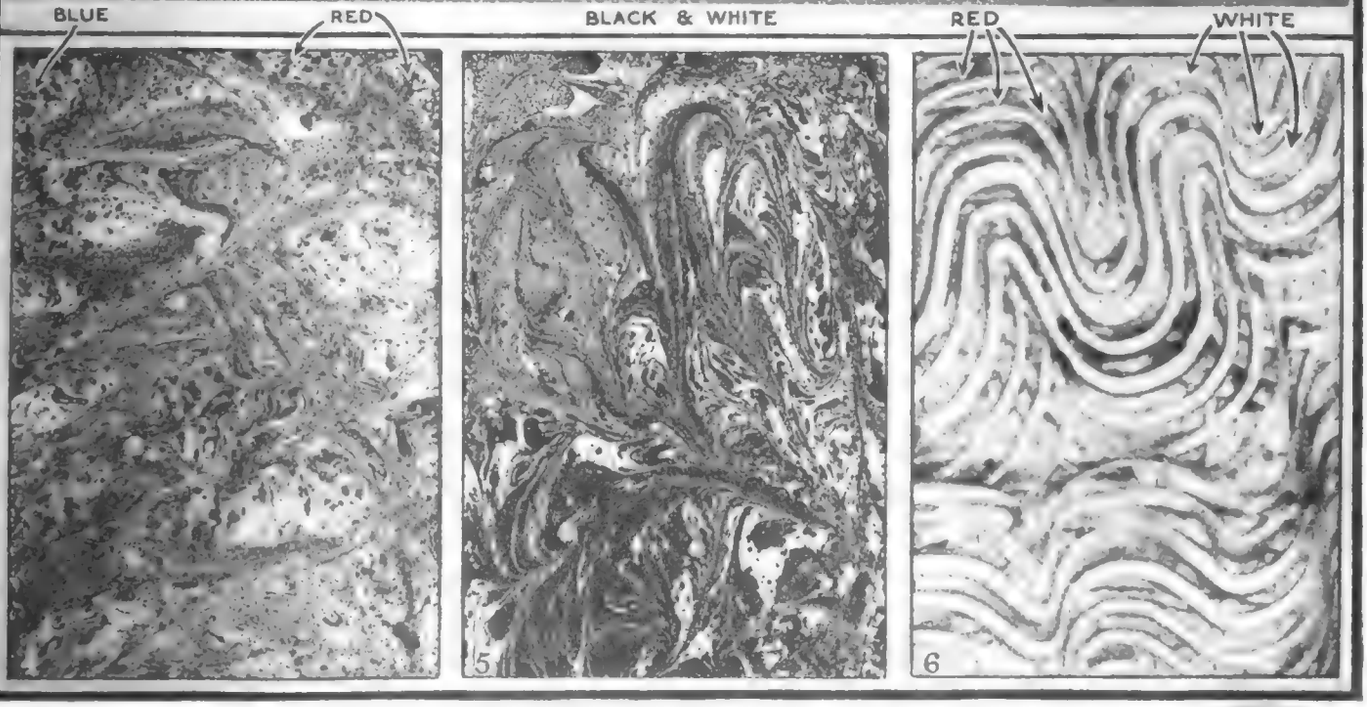
Any Kind of Paper May Be Used to Take the Print. The Water Solution is Made of Gum Tragacanth (Powdered) Which is Dissolved in a Little Water and Made Into a Paste. The Paste is Then Diluted to the Consistency of Milk. After the Different Colors Have Been Spattered on the Surface the Paper is Lightly Placed in a Floating Position Where It is Left for Ten Seconds. It Is Then Lifted from the Tray by Grasping One of the Floating Ends.

Starch Paper is Made Much More Simply. The Process is to Dissolve Half a Teaspoonful of Starch in Half a Glass of Water, Then Dilute Into Half a Pint of Boiling Water. If Necessary, Boil Till Clear and Glassy, Then Add Water Color Tints. Brush on the Paper with Stiff Bristles. For Designs, Draw a Comb or Other Toothed Instrument Over the Surface of the Coated Paper as Shown in the Above Photo. By Drawing a Feather Over the Paper a Marbling Effect is Obtained.

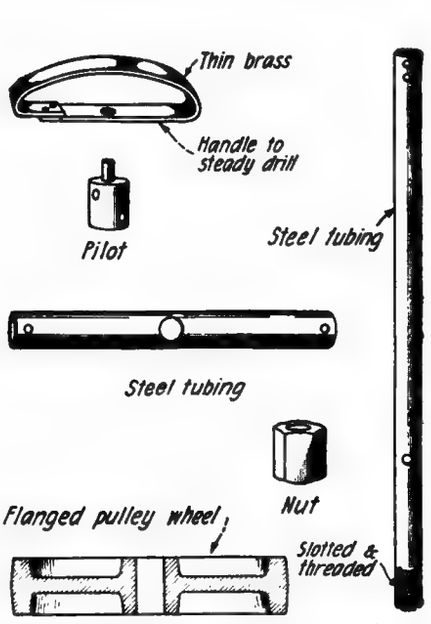
Below is Shown a Specimen of the Decorative Work Done in Blue and Red. The Two Colors Were Spattered on the Water Where They Formed Small Circles. Then a Match Was Drawn Laterally Through the Surface of the Pan and the Design Below Resulted. A Little Experimentation with the Tints and Mixing Will Produce Many Novel Effects.

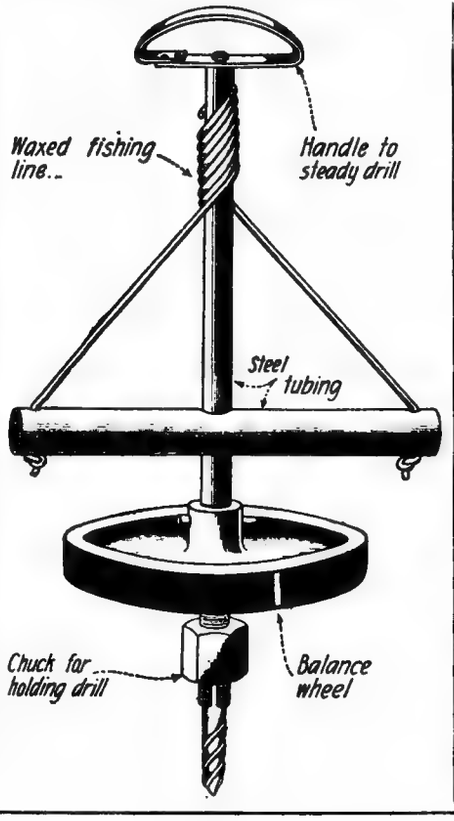
The Design Shown Below is in Plain Black and White. The Colors were Applied in Two Large Splotches at Each End of the Pan. As the Colors Will Not Mix on the Surface of the Water There is Little Danger in the Spattering Process. The Design Below Was Obtained by Drawing a Match Slowly from the Upper to Lower Corner.

All Sorts of Weird Designs Can Be Obtained in the Starched Tinted Papers. There Is a Great Deal of Pleasure in Making Them on Account of the Ease of Preparing the Mixture. Designs or Crests May Be Worked Into This Medium with a Very Good Effect. The Illustration Below Shows a Two-Color Design on Paper Coated By Dr. Bade.



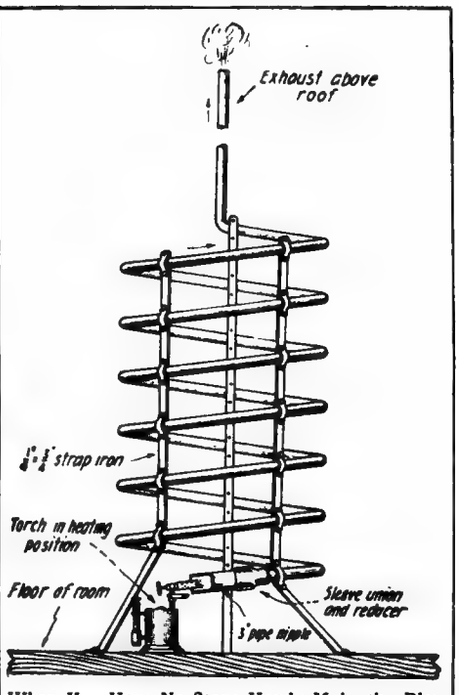
Simply Built Hand Drill





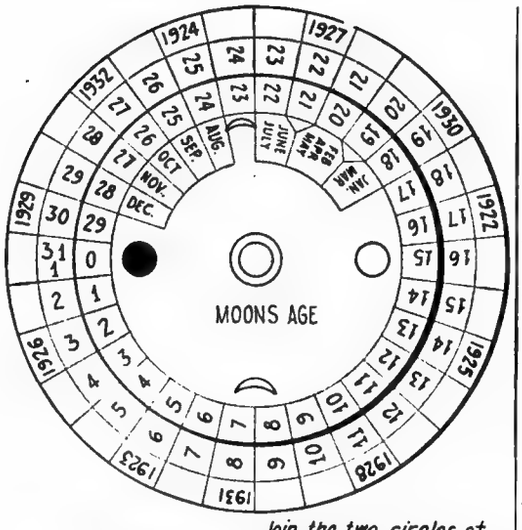
The Drill Shown (Right) is Made from Scrap Parts That May Be Found in Any Tool Chest. The Spindle and Hand Piece Are Made of Steel Tubing. The Chuck is the Split End of the Spindle with a Nut. For a Balance Wheel Any Small Pulley May Be Used. The Handle is Made of a Strip of Spring Brass. The Drill is Operated by Winding the Cord on the Spindle and Then Pushing Down. Allow the Cord to Rewind in Other Di ection and Push Again.

Torch Stove

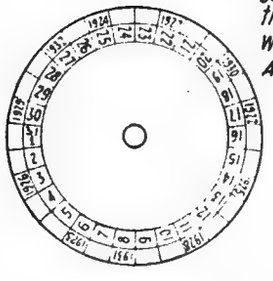


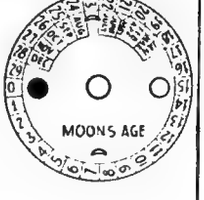
When You Have No Stove Handy Make the Blow Torch Serve. Wind Several Turns of 1½ In. Pipe Into a Spiral. Leave Enough for an Exhaust. Support Coils with Three ¼ x ¾ Iron Straps Fitted with Clamps. Put a 3-in. Nipple at the Base in Which to Insert Torch. The Heat Can Easily Be Regulated and the Torch Will Help Ventilate the Room.—L. M. Jordan.

Moon's Age Chart



Join the two circles at the centres.. Then you will get the MOON'S AGE INDICATOR..





To Find the Age of the Moon at Any Time, Join the Circles Concentrically and So They Can Be Moved Simultaneously. To Find Age of the Moon Turn the Inner Circle Until the Present Month [illegible] in the Column with the Present Year. [illegible] the Inner Circle for Moon's Age [illegible] mum Error with This Chart is One [illegible].—Toshio Kawamura.

Extension Phone From Extra Parts

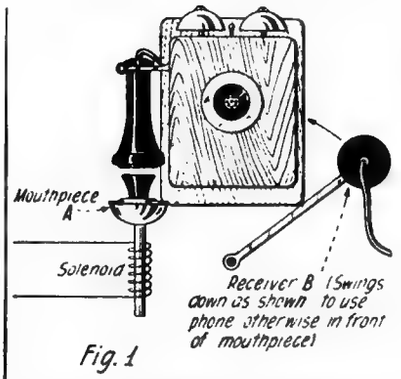


Fig. 1

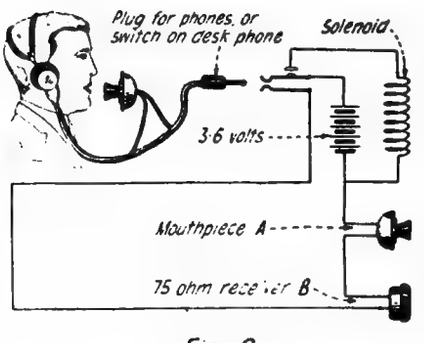


Fig. 2

This Telephone Extension is Easily Made and as Many as Are Wanted Can Be Used, Once the Transmitter and Receiver Have Been Fixed to the Outside Instrument. A Regular Transmitter is Used and is Fastened so That it is about an Inch from the Receiver, as Shown in the Cut When the Receiver is at Its Highest Position on the Hook. A 75-Ohm Receiver is Braced so it Stands About a Quarter of an Inch from the Transmitter. The Hook-up is Shown to the Left. Thousand-Ohm Radio Receivers May be Used at the Receiving End. A 3 to 6 Volt Battery is Used.—Richard Ballou.

Method to Increase Range of Scales

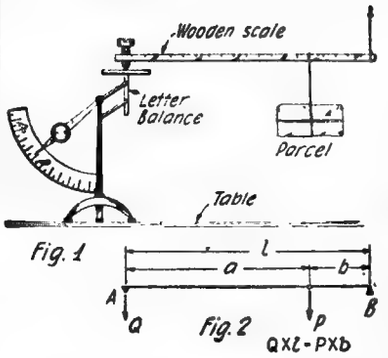


Fig. 1

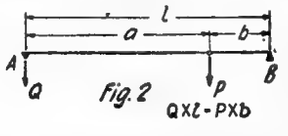


Fig. 2

QXl-PXb

The Capacity of a Small Scale Can Be Raised to Any Degree, by This System of Leverage. Pivot or Suspend Graduated Lever, at the Right End as Shown, and

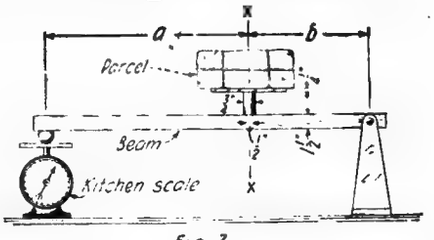
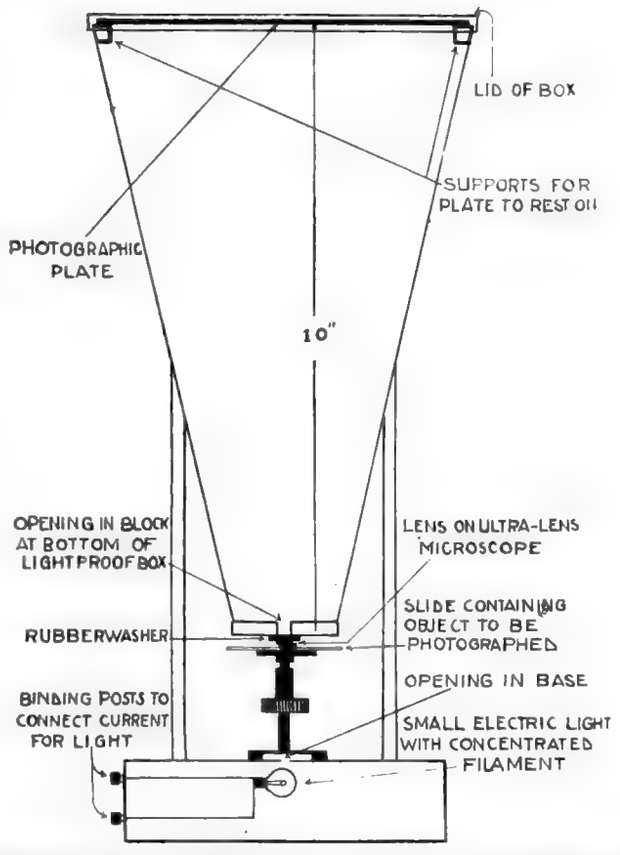


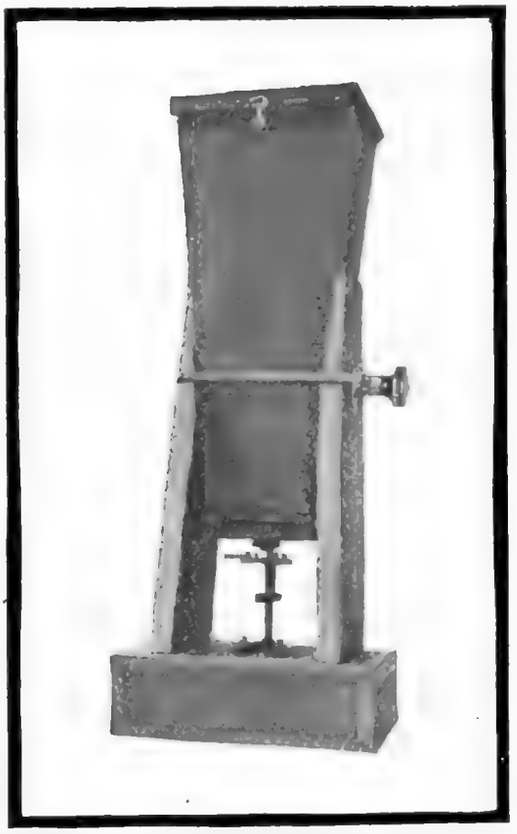
Fig. 3

Let the Other End, from Which a Sharp Pointed Screw Projects, Rest Upon the Center of the Balance Pan. The Object to be Weighed is Suspended Between the Pivot and the Scale and is Shifted to Right and Left Until the Scale Index Gives a Convenient Reading. Then Move the Object to the Nearest Division of the Lever and Read the Scale. Unknown Weight Equals Length of Lever, Divided by Distance from Pivot to Weight Multiplied by Index Reading of the Scale or Unknown Weight. —C. A. Oldroyd.

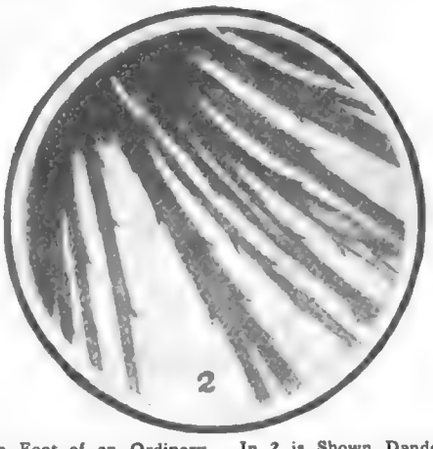
Camera For Use With Microscope


LID OF BOX
SUPPORTS FOR PLATE TO REST ON
PHOTOGRAPHIC PLATE
10"
OPENING IN BLOCK AT BOTTOM OF LIGHTPROOF BOX
LENS ON ULTRA-LENS MICROSCOPE
SLIDE CONTAINING OBJECT TO BE PHOTOGRAPHED
RUBBERWASHER
OPENING IN BASE
BINDING POSTS TO CONNECT CURRENT FOR LIGHT
SMALL ELECTRIC LIGHT WITH CONCENTRATED FILAMENT

Cross-Section Shows Lightproof Box Taken from Old Enlarging Camera or Constructed by Amateur Supported Over Microscope. Top Must Fit Light-Tight. Microscope and Camera Are Supported on Cigar Box.

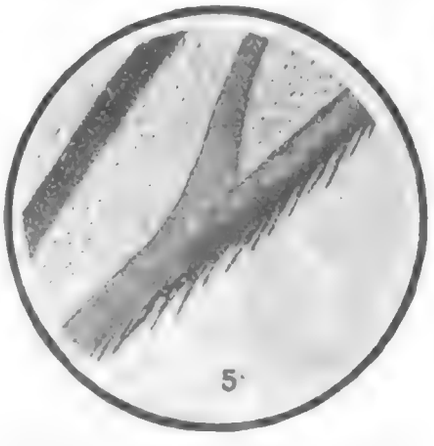


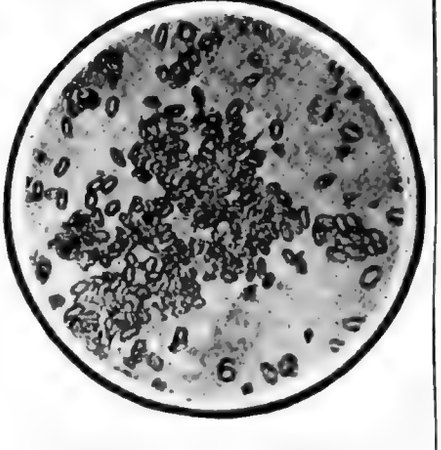
In Picture of Apparatus (Above) Brass Strip Movable Support for Camera is Shown. Light for Illuminating Subject Must Be Directly Under Slide, in Cigar Box. Use a Flat Black Paint Only, on Apparatus.



Number 1 Shows a Section of the Feelers from the Foot of an Ordinary Moth. Specimens for Photographing Are Mounted in the Same Manner as They Are for Microscopic Examination; on Slides, in Balsam. 4—Hook on Bumble-Bee's Foot.

In 2 is Shown Dandelion Seed. No. 3 is Section from Mosquito's Wing. No. 5 Wing of Ordinary House Fly. No. 6 Plant Pollen. All These Photos Were Made with the Above Apparatus, Including 125 Diameter Microscope of the Ultra-Lens Type.



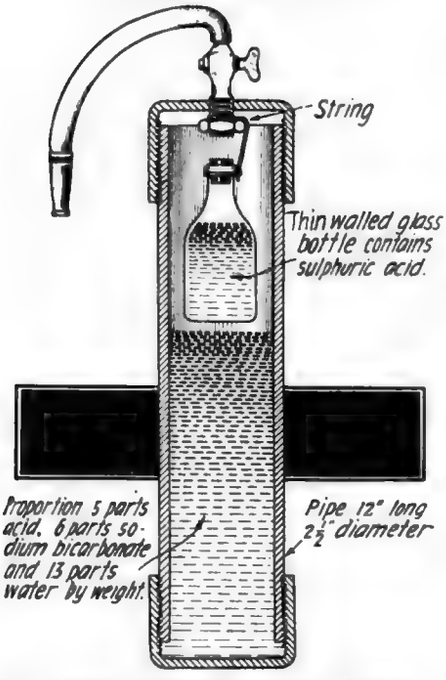


HOW-TO-MAKE-IT

This department will award the following monthly prizes: First prize, $15.00; second prize, $10.00; third prize, $5.00.

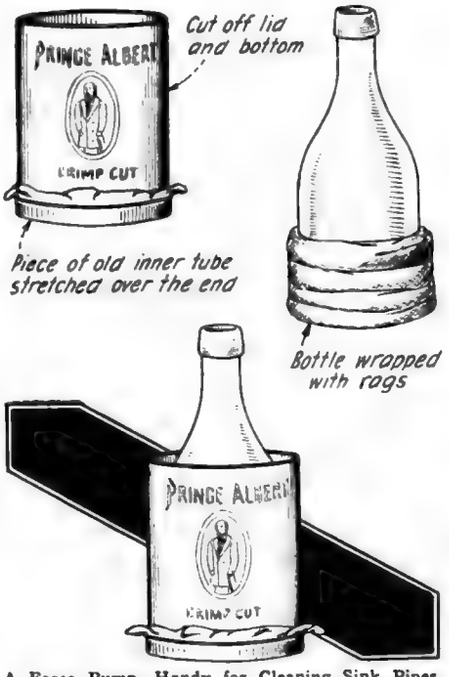
The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department a monthly series of prizes will be awarded. For the best idea submitted a prize of $15.00 is awarded; for the second best idea a $10.00 prize, and for the third best a prize of $5.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE $15.00


String
Thin walled glass bottle contains sulphuric acid.
Proportion 5 parts acid, 6 parts sodium bicarbonate and 13 parts water by weight.
Pipe 12" long 2½" diameter

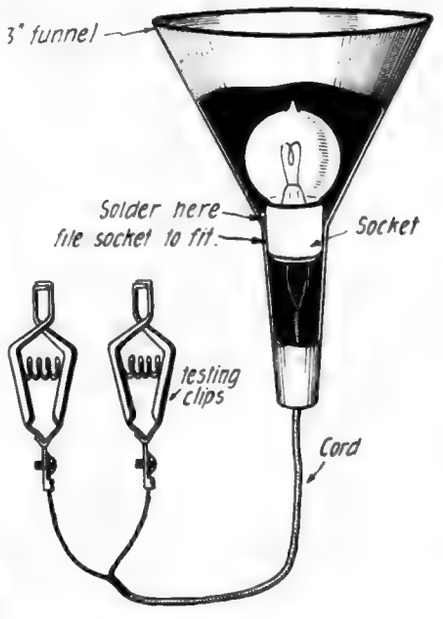
The Fire Extinguisher Shown Above Contains a Bottle of Sulphuric Acid Suspended from a Nut Screwed on the Cock. The Pipe is Filled Three-Fourths Full of Water Saturated with Bicarbonate of Soda. To Operate, Shake Tank to Break Bottle, Open Cock and Spray on Base of Fire.—H. P. Clay.

SECOND PRIZE $10.00



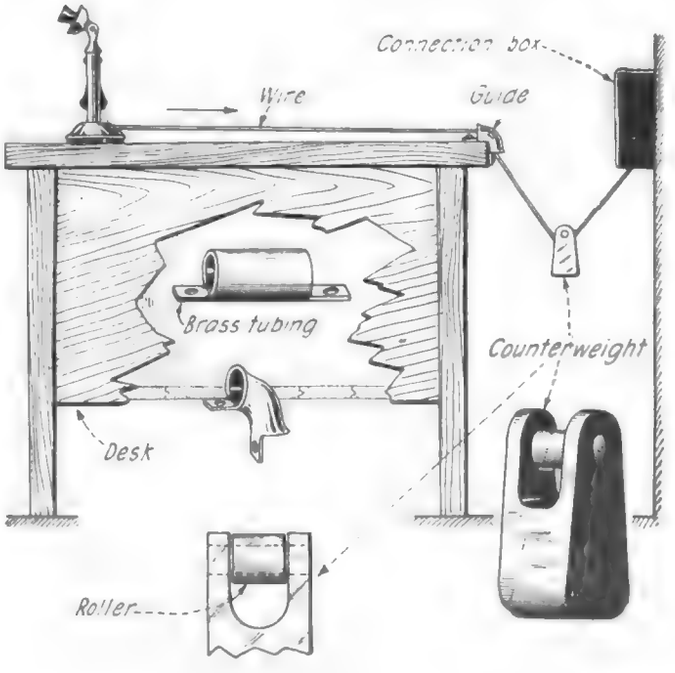
A Force Pump, Handy for Cleaning Sink Pipes, Can Be Made from a Circular Can and Bottle. Wrap the Bottle with Rags So It Fits Snugly. Place a Piece of Inner Tube Over the Bottom of the Can in Order to Get Tight Contact Over the Sink Strainer and Then Work the Bottle Up and Down Vigorously.—Thos. Barta.

THIRD PRIZE $5.00



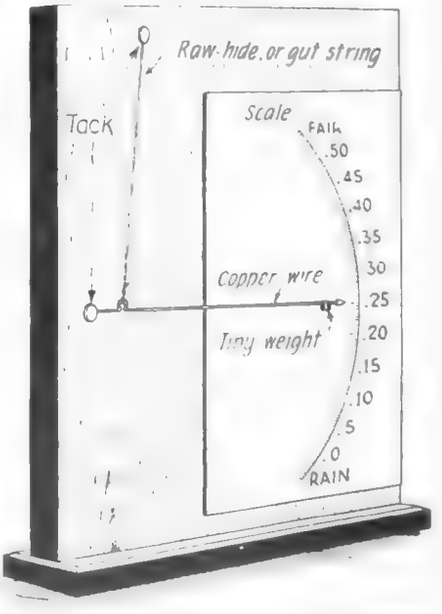
A Trouble Light Can Be Made from a Funnel and Headlight Socket. Solder Socket in After Cord Has Been Drawn Through the Neck of the Funnel. Attach Battery Clips to the Ends of the Cord. A 3-Inch Funnel Will Serve the Purpose Best. It's Not Necessary to Fasten the Cord In. —Stanley Fitach.

For A Kinkless Phone Cord



Keep the Telephone Cord Straight by Running it Through a Guide Made of Brass Pipe and Placing a Counter Weight Between the Connection Box and the Guide, as Shown in the Sketch at Left —G. A. Luers.

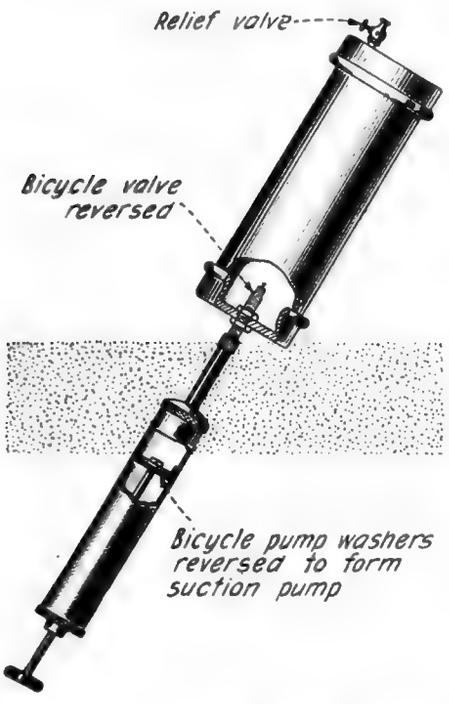
Rawhide Barometer



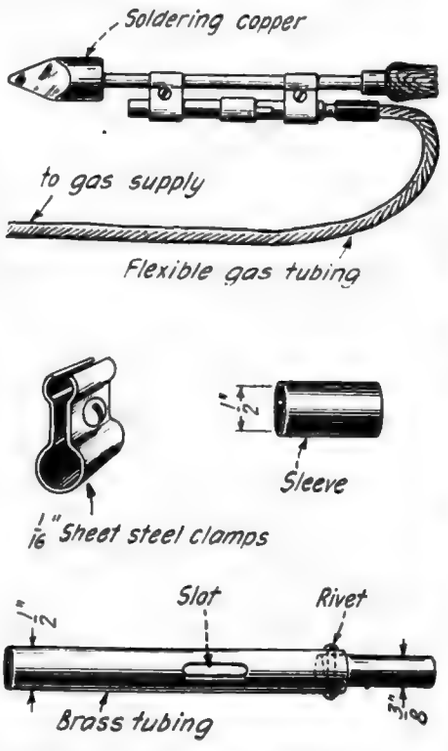
The Expansion of Rawhide Can Be Used to Make a Barometer by Making a Small Pointer as Shown in the Sketch and Attaching a 6-Inch Length of the Leather to It. The Wire Should Be Heavy Enough to Keep the Rawhide from Kinking. A Dial is Drawn at the Right.

Wrinkles, Recipes Formulas

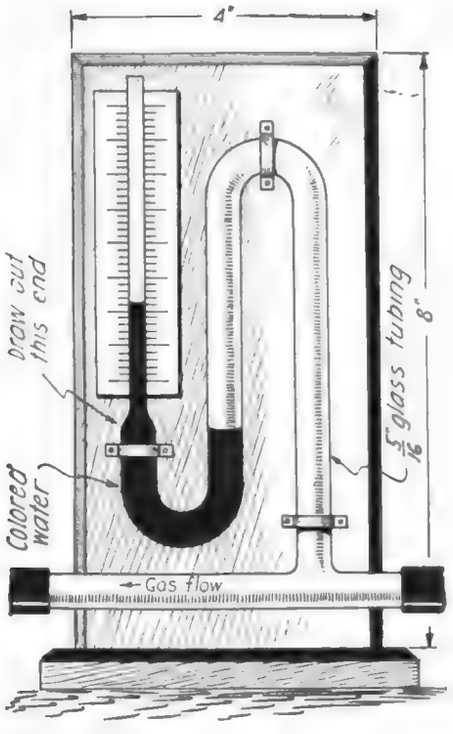
EDITED BY S. GERNSBACK



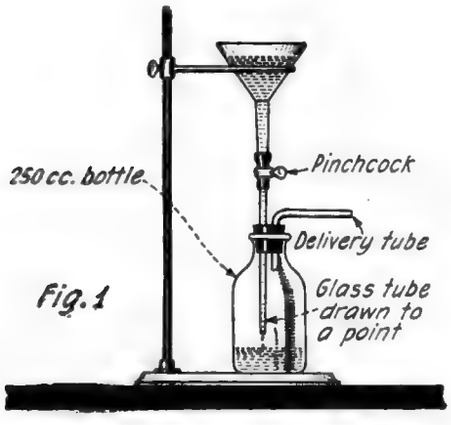
The Beat Method of Popping Corn is in a Vacuum. The Device Illustrated Here is Made of a Short Length of Large Pipe. The Corn is Inserted and the Cylinder Heated and the Air Exhausted.—W. E. Dodge.

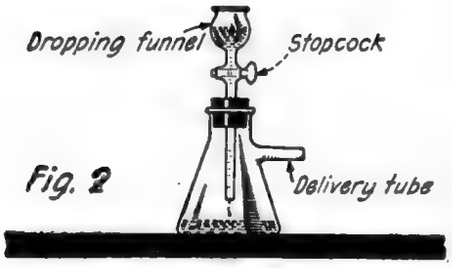


The Burner Used in the Above Heater is of the Bunsen Type. The Sleeve is Placed Over the Slot in the Tube and the Gas Line Attached to the Shank. The Whole is Attached to the Iron with the Clips.—G. A. Luers.

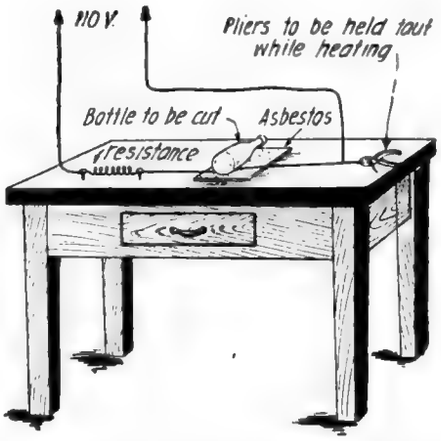


The Above Illustrated Gas Gauge is Simple in Construction. The Bend is Made and the End Drawn Out. The Tee is Then Made. If the Bends are Made While the Glass Rests on a Flat Surface a Neat Product Will Result.—Carlyle Weiss.



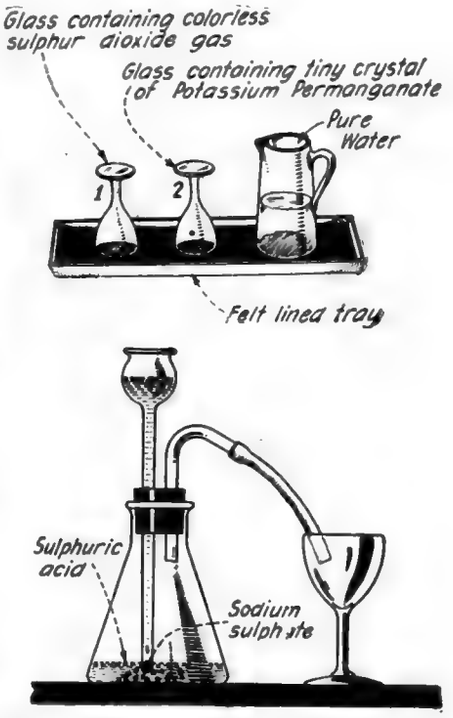


Much Broken Apparatus and Ruined Experiments Result from Making Gas by the Heat Method. With the Apparatus and Formulas Given This Can Be Dispensed With.



The Heat Through the Resistance Wire (Nichrome or German Silver) Quickly Cuts the Bottle in a Clean Line Where the Wire is Wrapped Around it.—Frank Lindstaedt.

The "Cold" Gases Are Made from the Following Formulas: Oxygen—Sodium Peroxide in Flask. Water in Funnel. Hydrogen—Granulated Zinc and Dilute Hydrochloric Acid. Ammonia—Lumps of Caustic Potash and Ammonium Chloride. Chlorine—Solid Potassium Permanganate and Hydrochloric Acid. Hydrogen Sulphide—Iron Sulphide and Dilute Sulphuric Acid. Sulphur Dioxide—Sodium Sulphite and Hydrochloric Acid. Carbon Dioxide—Calcium Carbonate and Dilute Hydrochloric Acid.—Chas. Tenny.

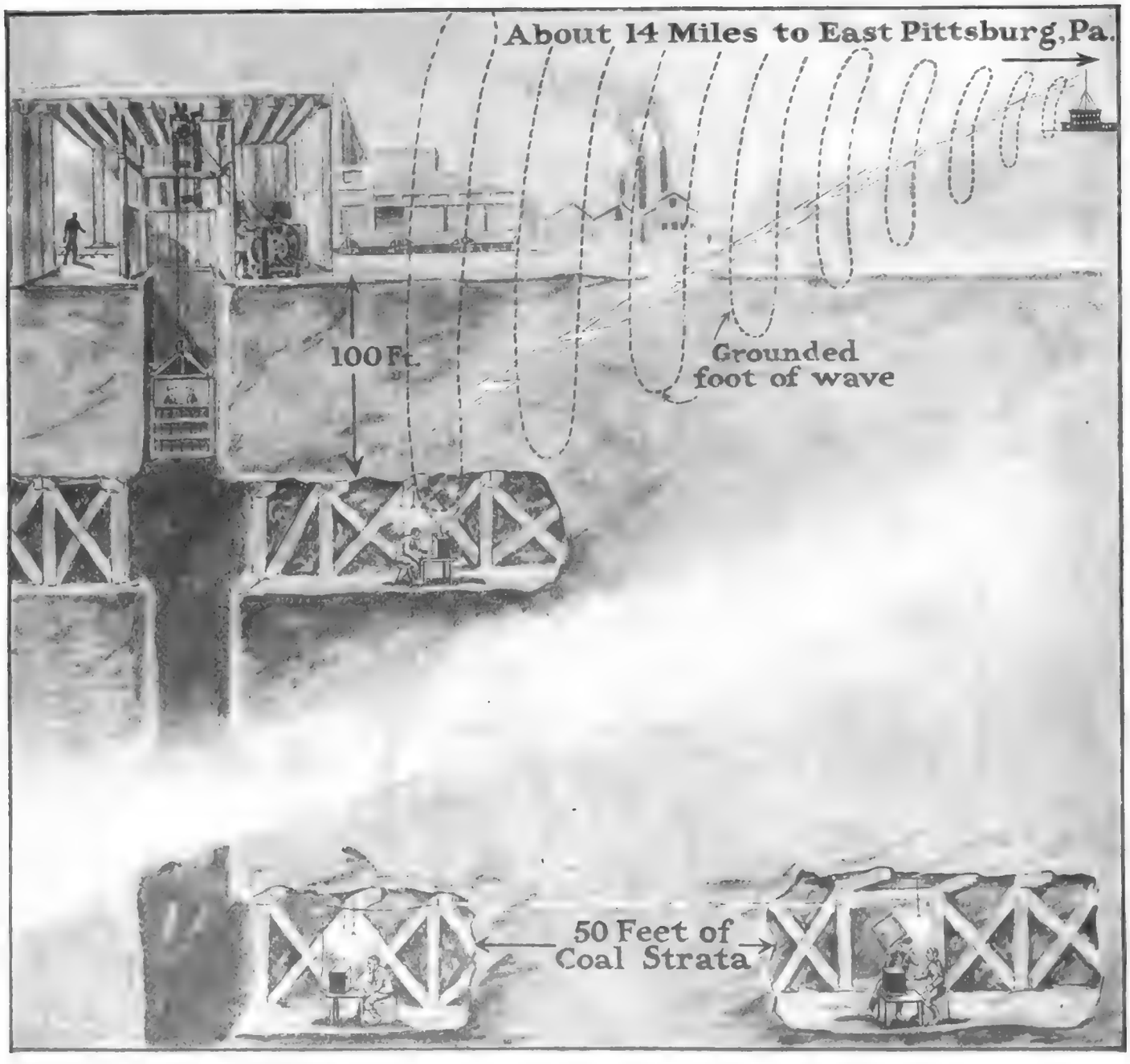


When Water is Poured Into Tumbler 1 It Remains Clear. When Poured Into Tumbler 2 It Turns Wine-red. When Returned to the Pitcher the Solutions React. Water is All Clear Again. Gas Made from Sulphuric Acid on Sodium Sulphite as Shown in Bottom Cut.—Chas Tenney.

RADIO DEPARTMENT

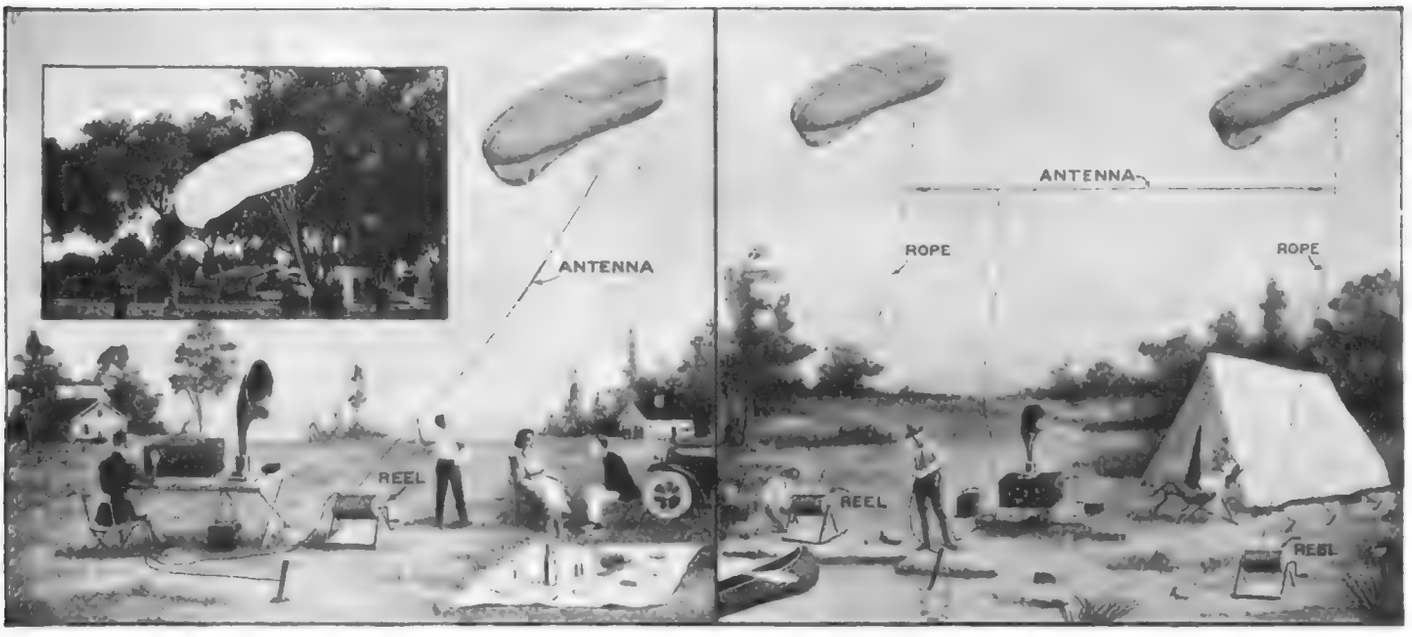
How Radio Will Aid Mine Rescue

By W. B. ARVIN



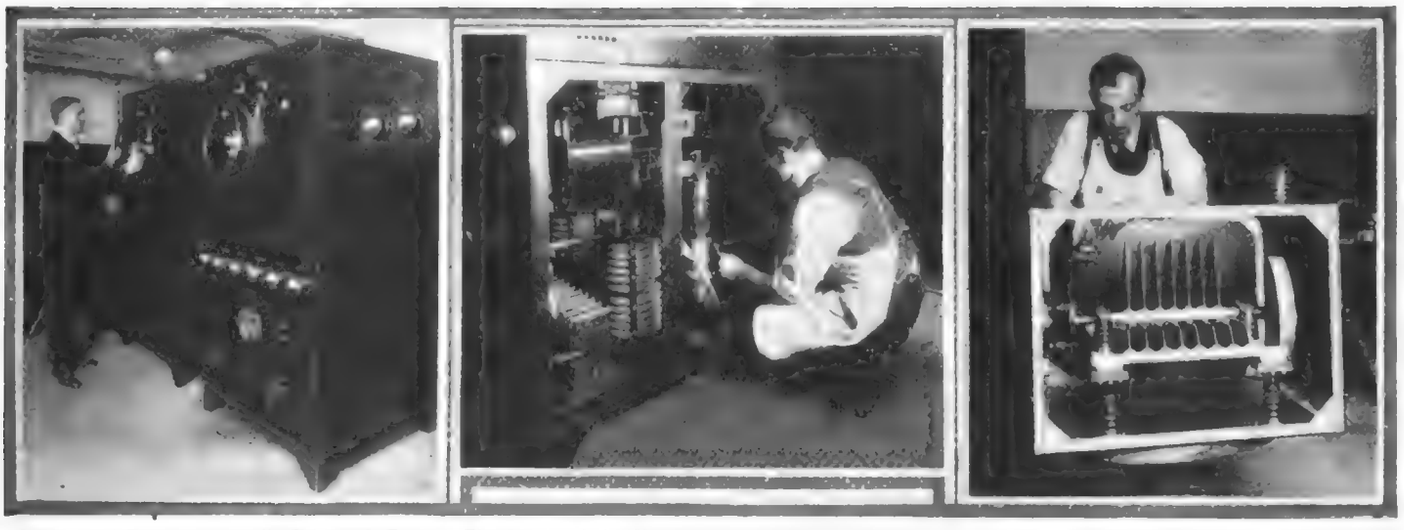
That Future Mine Disasters May Be Averted to a Great Extent Through the Use of Radio Communication is a New Theory on Which the United States Bureau of Mines is Constantly Making Experiments Through Which They Hope to Remove a Great Deal of Danger Encountered in Mine Accidents. In the Illustration Above is Shown the Results as Set Out in the Latest Report Made to the Bureau on Investigations Carried on at the Government's Experiment Mine Near Bruceton, Penn. The Experiments, Made Under the Supervision of Mr. J. J. Jakowsky, Showed That Reception from an East Pittsburgh Station, Fourteen Miles Away, Was Possible with the Receiving Set 100 Feet Underground. Transmission Was on 360 Meters. The Most Promising Results Were Obtained in Experiments Where Both Transmission and Reception Were Carried on Underground. Waves Were Broadcast Through a Fifty-Foot Strata of Coal, as Shown in the Lower Part of the Drawing. Reception Was Clear and Distinct Though the Strength of the Signals Decreased in Direct Ratio to the Thickness of the Strata. A Horizontal Antenna Was Found to be Practically Useless While a Vertical Loop of One Turn Worked Admirably. The Theory Held by the Experts is That the Direction of the Strata Has Little Effect on Reception But That Its Density May Cause Slight Variations in the Strength of the Signals.

Balloons to Support Antennae



A Kite Balloon Has Been Designed by Mr. Roy Knabenshue of Burbank, California, for Supporting a Radio Antenna. It is Shown in the Photograph in the Upper Left-Hand Corner and Two of Its Uses Are Illustrated Above. Excellent Results Were Obtained With the Vertical Antenna Used As Shown at the Left. The Illustration at the Right Shows the Manner in Which Balloons Were Used in the Late World War, as Then Described in This Magazine.

Leviathan's Radio Transmitter

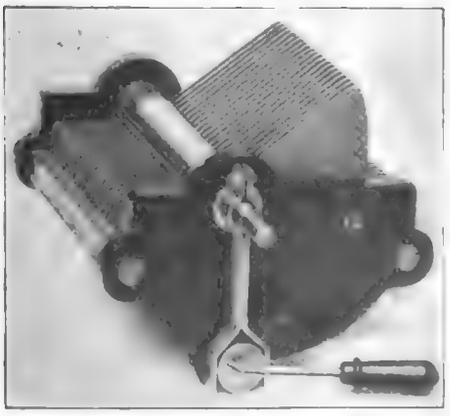


Testing and Tuning the Radio Telegraph Transmitter on Board the Leviathan is Shown Above. This Set Has Been a Great Success for Long Distance Transmission.

The Inside of the Vacuum Tube Unit is Illustrated, Showing the Water-Cooled Tubes Designed to Operate With a Plate Voltage of 6000 Volts Great Success Has Been Achieved With This Arrangement.

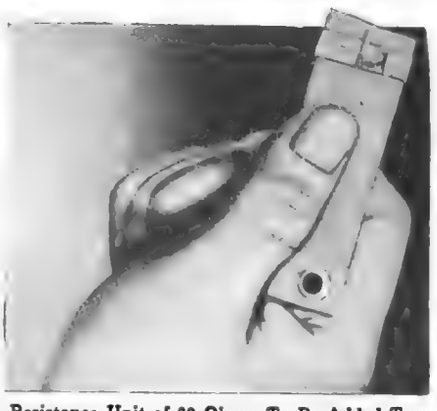
One of the Variable Condensers on the Leviathan's Transmitter, Compared With a Standard Variable Condenser Held by the Gentleman.— Photos, C. W. Tucker.

Variable Condenser



A New Type of Variable Condenser Giving a Straight Line Curve and Equipped With An Exceedingly Accurate Vernier. This Instrument is Made in Standard Sizes, of Brass or Aluminum.

30-Ohm Resistance



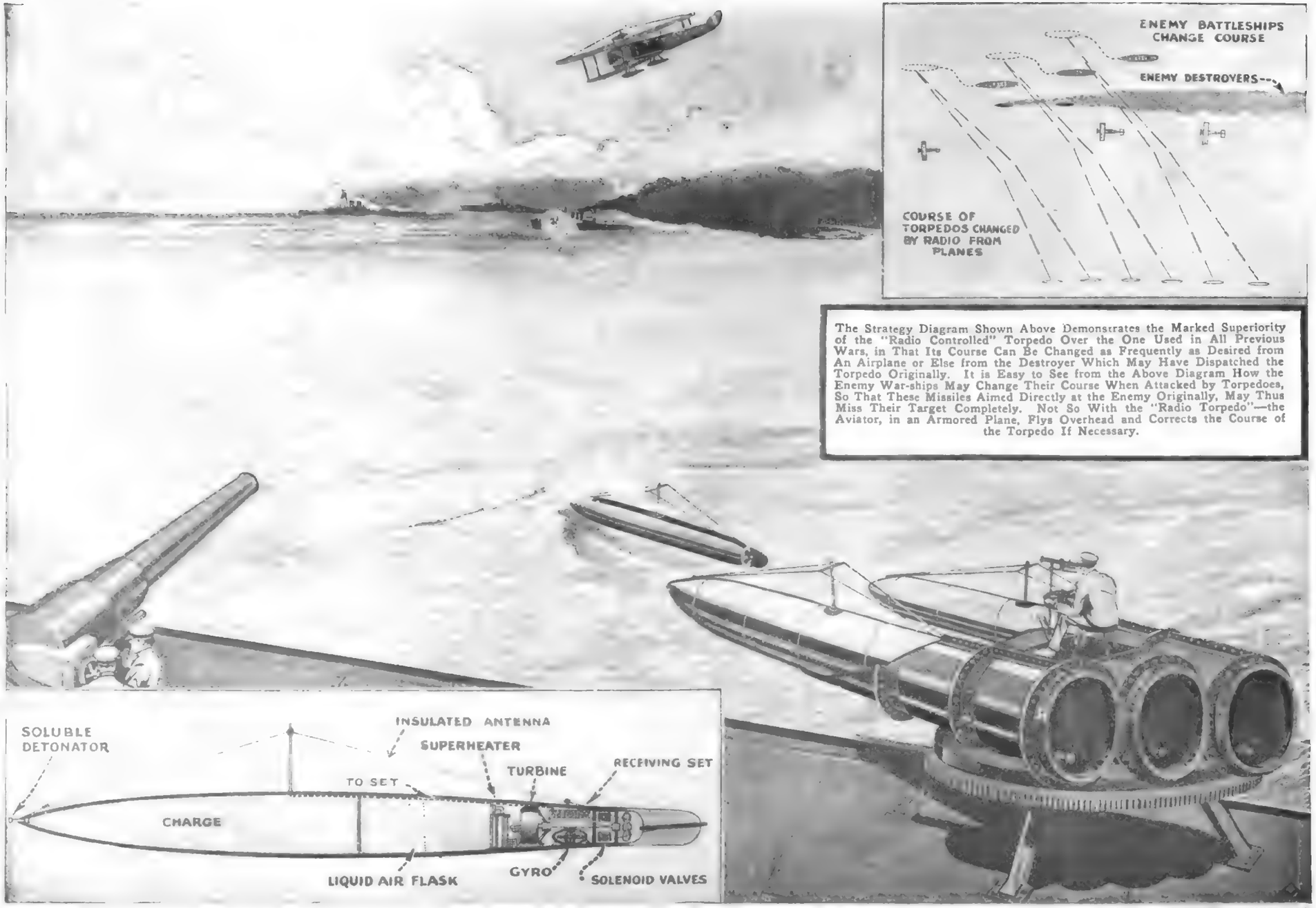
A Resistance Unit of 30 Ohms, To Be Added To a Standard Vacuum Tube Rheostat For Use With Vacuum Tubes Consuming Only One-Quarter of an Ampere or Less is Shown Here.

The Radio Doll

Radio Has Invaded Toy-Land and Small Imitation Receiving Sets With Dolls Are Being Shown in the Up-To-Date Toy Departments. — Photo by J. E. Dadswell.

Radio-Directed Torpedo of To-morrow

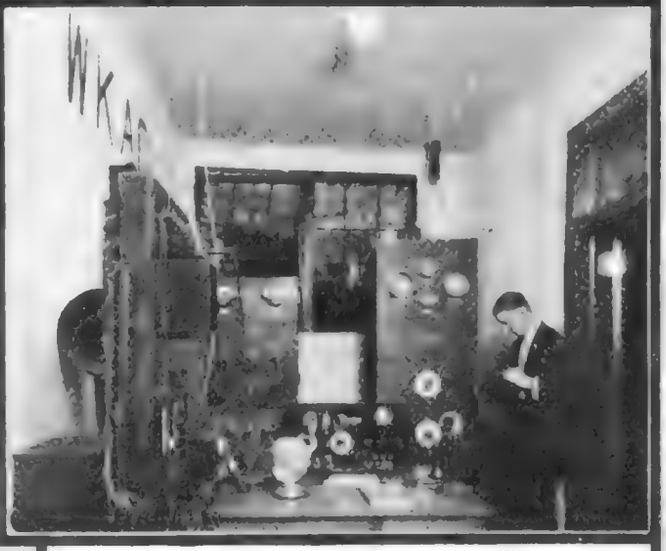
The Strategy Diagram Shown Above Demonstrates the Marked Superiority of the "Radio Controlled" Torpedo Over the One Used in All Previous Wars, in That Its Course Can Be Changed as Frequently as Desired from An Airplane or Else from the Destroyer Which May Have Dispatched the Torpedo Originally. It is Easy to See from the Above Diagram How the Enemy War-ships May Change Their Course When Attacked by Torpedoes, So That These Missiles Aimed Directly at the Enemy Originally, May Thus Miss Their Target Completely. Not So With the "Radio Torpedo"—the Aviator, in an Armored Plane, Flys Overhead and Corrects the Course of the Torpedo If Necessary.



© 1923 By SCIENCE & INVENTION

The Large Illustration Above Shows the Triple Torpedo Tube Mounted on the Deck of a Destroyer With the Center Radio-Controlled Torpedo Being Discharged Into the Water Toward the Enemy Vessels. The Airplane Is Seen Flying Above Ready to Keep An Eagle Eye On It So As to Send Out Any Correcting Radio-Control Impulses That May Be Necessary. The Detailed View in the Lower Left-Hand Corner of the Illustration Shows the Interior Arrangement of The Radio-Controlled Torpedo. Details by Graser Schornstheimer, Special Naval Writer for Science & Invention.

BROADCAST STATIONS



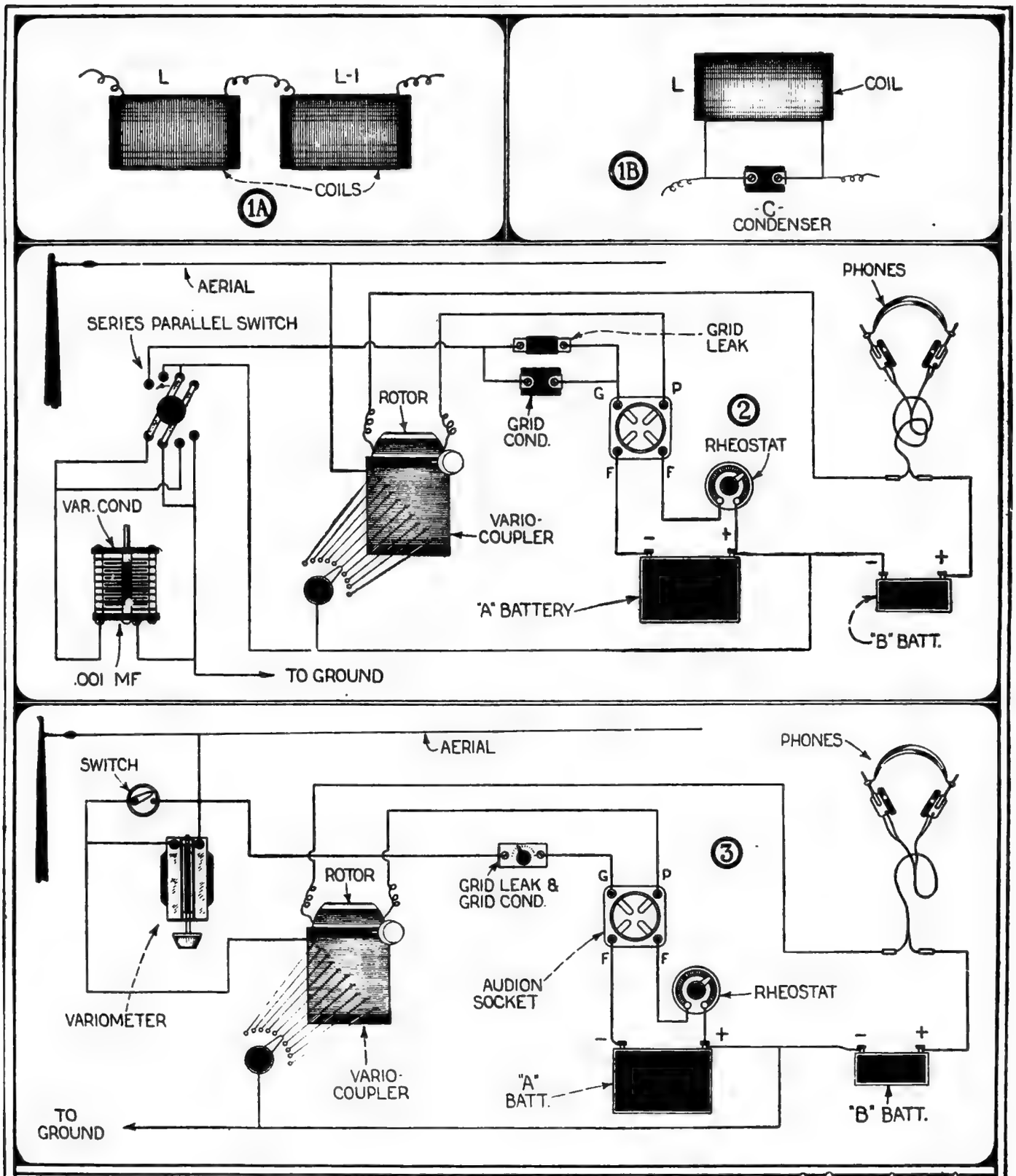
Upper Left: The Antenna System of Station WKAQ, Porto Rico. Above: The Operating Room of WKAQ Showing One of the Operators Checking Up the Wave-Length With a Wave-Meter. Left Center: The Studio of the Same Station.

Below: A View of the Extremely Neat Power Room of WKAQ. The Motor-Generators Appear on the Right and the Various Instruments and Apparatus Necessary for the Operation of the Station May Be Seen Around the Wall. This Station Has Been Heard in New England, Nova Scotia, and Many Cities Throughout the United States. The Station Proves to Be An Important Link Between the Island and Distant Places. Lower Right: The Monitoring Set of WKAQ on the Desk, and the Voice Amplifier on the Wall. The Operator Can Check Up On the Outgoing Programs by Means of His Receiving Set.

Above: The Artists' Rest Room at WKAQ. A Radio Receiving Set is Provided for Their Entertainment Between Selections.

Receiving the New Wave-Lengths

By MARIUS LOGAN

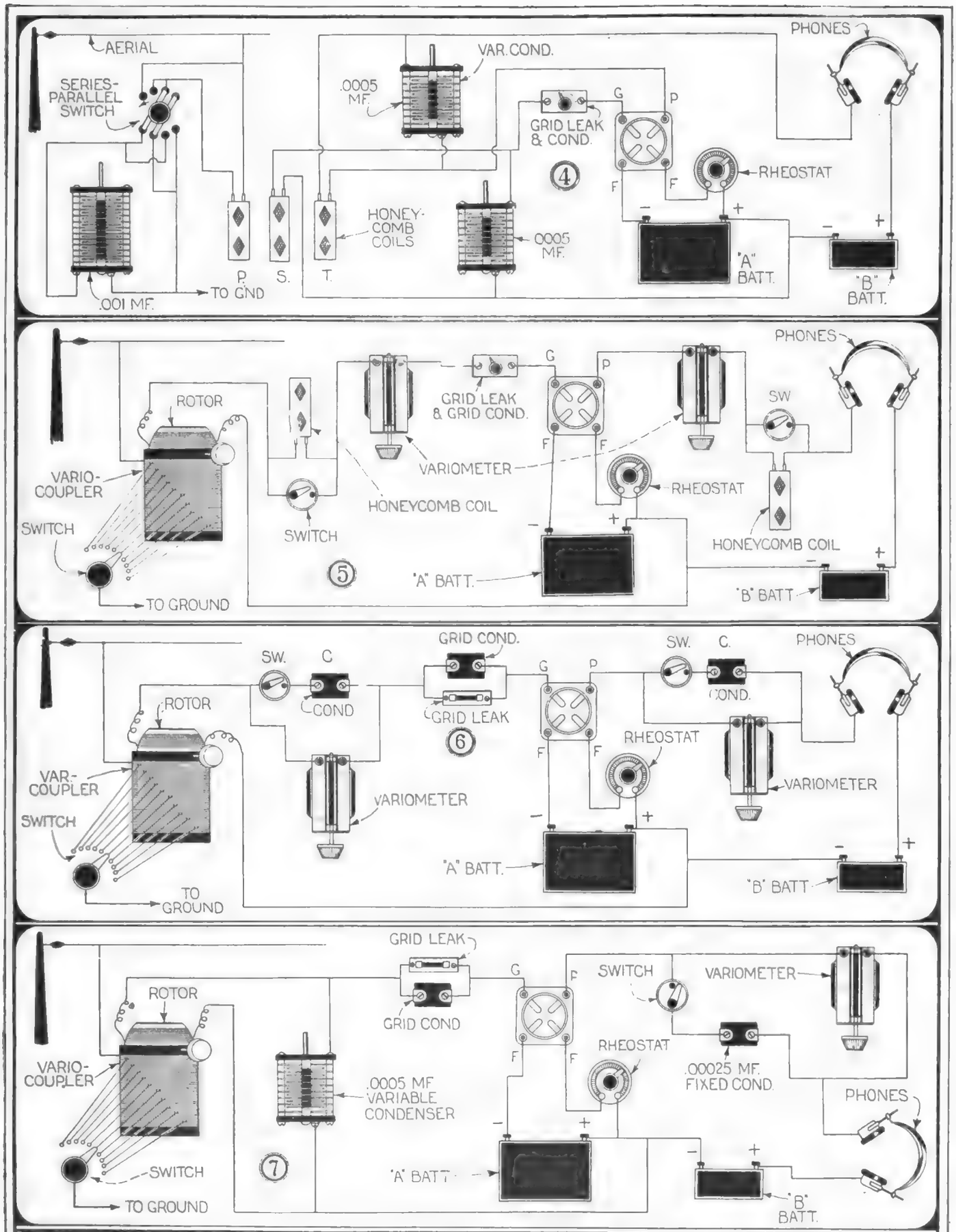


In Fig 1 Are Shown Two of the Methods of Loading an Inductance. If L has a Natural Wave-Length of 300 Meters and L 1 is of the Same Construction Then the Total Wave-Length to Which the Two Coils, Connected as Shown, Will Tune, Will Be 600 Meters.

In Fig. 1 B, Coil L May Be Loaded to Respond to a Wave-Length Higher Than Its Natural Period, by Connecting Across Its Terminals a Small Fixed Condenser as Indicated at C. This Particular Connection is Usually Termed a Shunt or Parallel Connection.

The Single Circuit Tuner Illustrated in Fig. 2 May Be Made to Receive on Higher Wave-Lengths Than Ordinarily, by Placing a Variable Condenser, with a Series-Parallel Switch, in the Circuit as Shown. Connect Condenser in Parallel for Long Waves; in Series for Short Waves.

Another Method of Loading a Single Circuit Tuner is Shown in Fig. 3. It Consists of Placing a Variometer in Series with the Stator of the Vario-coupler. Thereby Increasing the Natural Wave-Length of the Set. By Means of the Switch Illustrated, the Variometer May Be Shorted.



A Standard Three Honey-comb Coil receiving Set May Be Loaded to Respond to Higher Wave-Lengths as Shown in Fig. 4. Here a Variable Condenser and Series-Parallel Switch is Used in the Primary as in Fig. 2, and the Secondary and Tickler Coils Are Loaded by Placing a .0005 mf Variable Condenser Across Them.

With the Ordinary Vario-Coupler and Two Variometer Short Wave Regenerative Circuit, the Grid and Plate Circuits Must Be Changed so as to Respond to the Higher Waves This May Be Accomplished as Shown in Fig. 5 by Using Two Honey-comb Coils with Two Small Switches for Short-Circuiting Them.

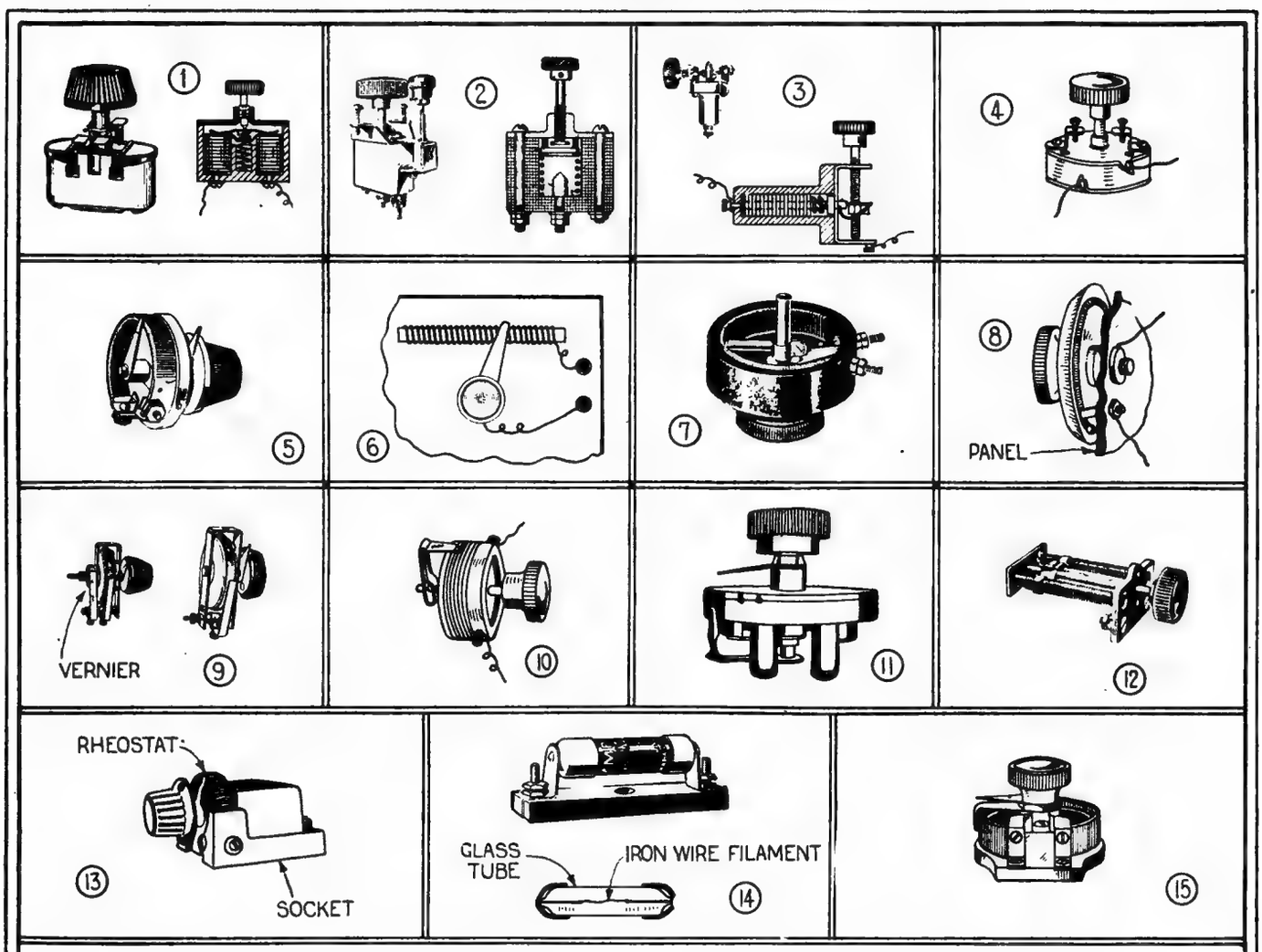
Another Method of Loading a Standard Three-Circuit Receiving Set is by Means of Two Small Fixed Condensers as Shown in Fig. 6 at Points Marked C. The Exact Size of These Condensers Should Be Determined by Experiment; Those with a Capacity of .00025 Mf. Will Give Good Results. Cut-out Switches Are Used

Another Form of Three-Circuit Tuner Employing a Variable Condenser to Tune the Grid Circuit is Shown in Fig. 7. A Small Fixed Condenser with a Capacity of .00025 Mf. is Shunted Across the Variometer in the Plate Circuit. It May Be That the Rotor of the Vario-Coupler Will Require a .001 M.F. Cond.

Radio for the Beginner

By ARMSTRONG PERRY

NO. 20 RHEOSTATS



In This Article the Various Styles and Types of Rheostats and Resistances Used in Radio Construction Are Shown. Figs. (1) and (2) Show Popular Types in Which the Resistance is Varied by Compression of Carbon in the Form of Discs in 1 and Granular Particles in 2. In the Following Illustration the Resistance is of Carbon Disks. Fig. 4 Works on a Similar Principle. In Numbers (5), (7) and (8) Are Shown Styles of V.T. Filament Rheostats. In (6) We Have the Simplest Home-made Variety. In Figs. (9) and (10) the Resistance Units Are Capable of Very Fine Adjustment. (In (9) the Vernier Gives the Fine Adjustment and in (10) All Parts of the Wire Are Available. The Types Shown at (11) and (12) Differ from the Other V.T. Types Only in Mounting and Adjustment Method. At (13) the Rheostat and the Tube Socket Are Combined. In (14) We Have an Automatic Iron Wire Ballast Resistance Unit.

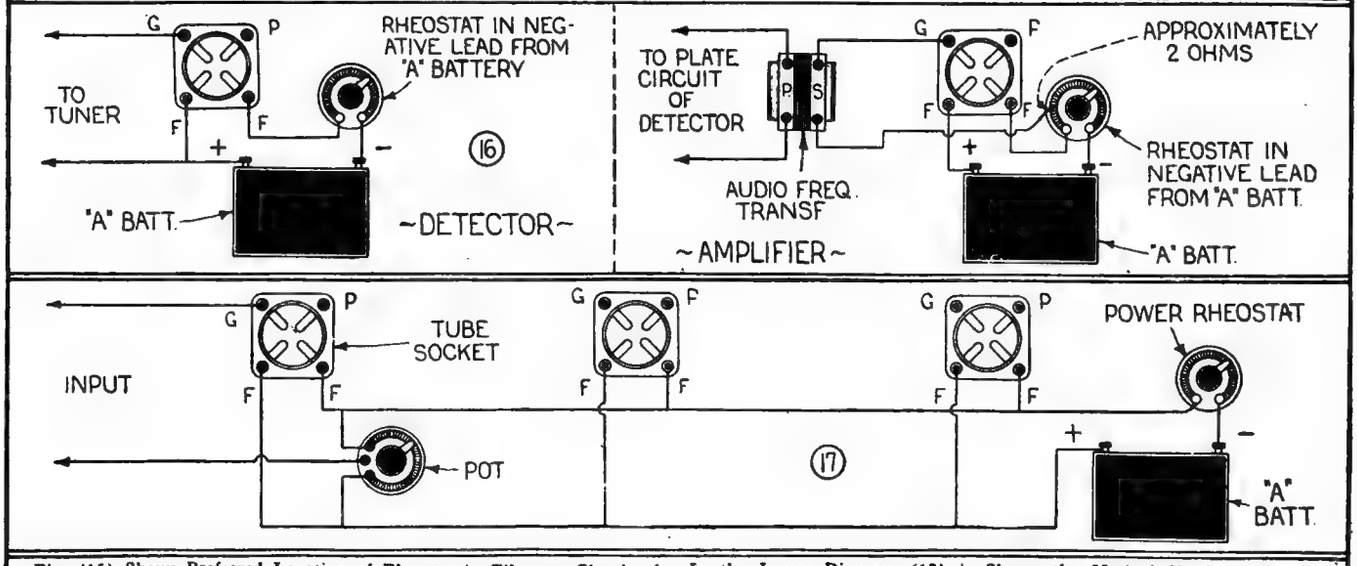
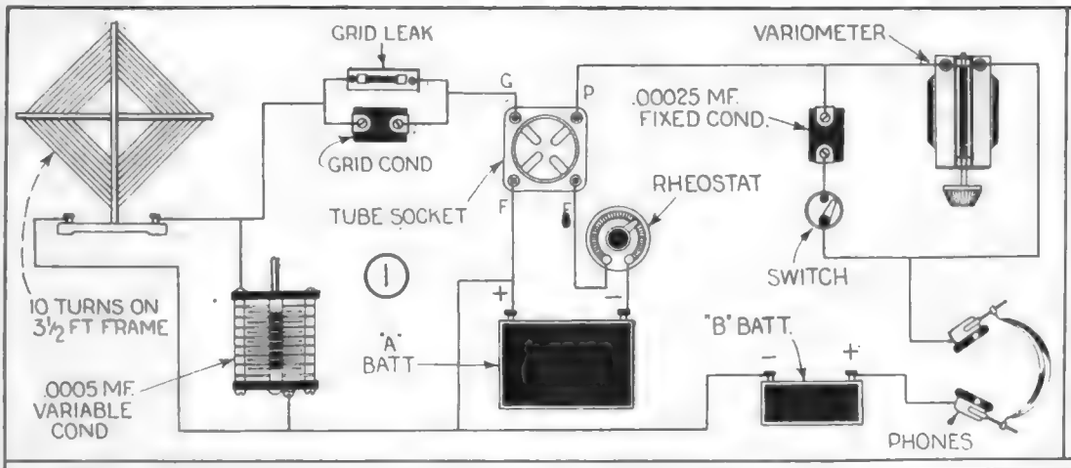


Fig. (16) Shows Preferred Location of Rheostat in Filament Circuit of a V.T. Detector. The Wiring Diagram at Right Shows a Trick Used by Several Manufacturers and by the Navy. The Grid Lead in the Amplifier Circuit is Connected to a Point Part Way Around the Rheostat Resistance Unit So That Approximately 2 Ohms Will Be in the Circuit.

In the Lower Diagram (17) is Shown the Method Used to Control Three Filaments with One Knob. It Also Shows the Connections of a 300-Ohm Potentiometer, a Good Style of Which is Shown in Fig. 15. This Latter Instrument Affords a Ready Control of the Grid Bias Voltage. It is Particularly Useful in Radio Frequency Amplifying Circuits.

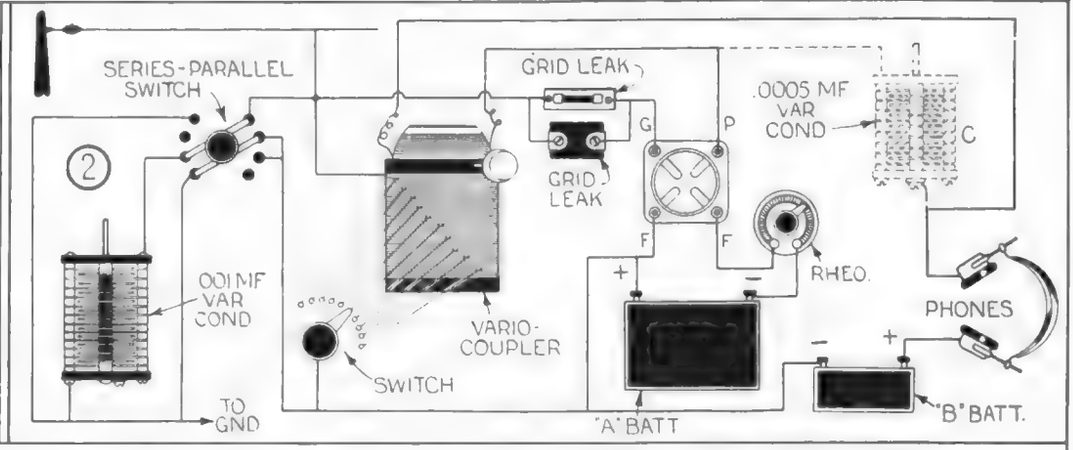
Four Good Single Tube Hook-Ups

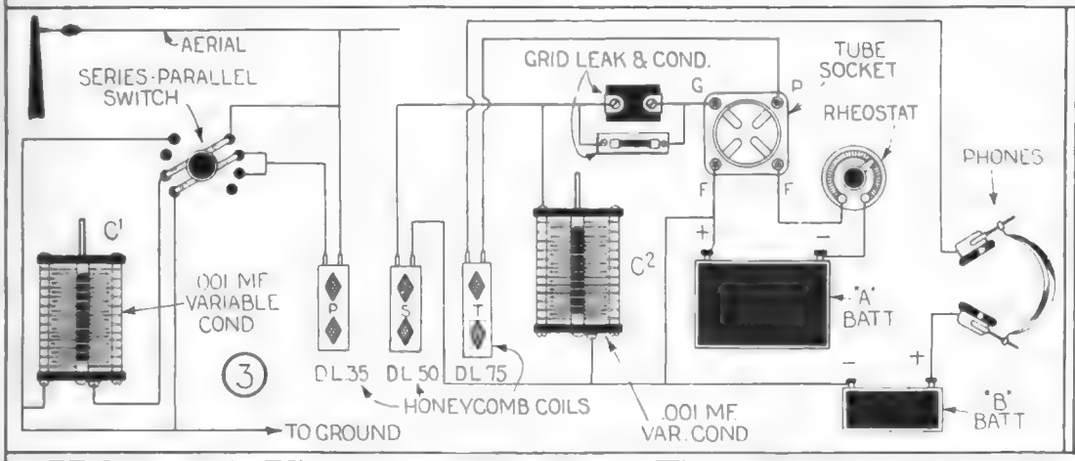
By MARIUS LOGAN



For Those Who Are Content to Listen to the Programs Rendered by the Local Broadcast Stations, and Who Are Unable to Erect an Outdoor Aerial, the Circuit of Fig. 1 is Well Suited. This Set Has Only Two Controls. The 23-Plate Variable Condenser Connected Across the Loop Aerial is the One and Only Tuning Control. Regeneration or Signal Strength is Controlled by the Variometer. The Fixed Condenser C is Used for Receiving on the Higher Waves, by Closing the Switch.

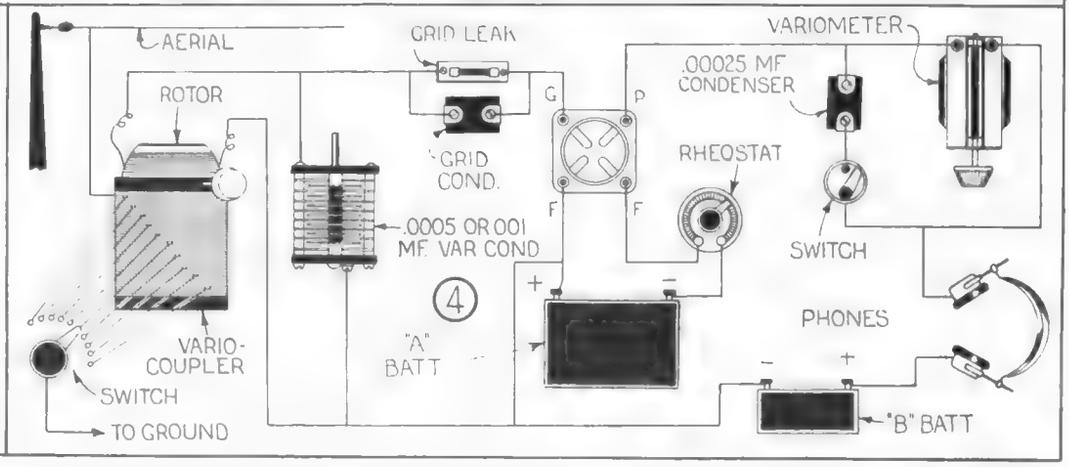
The Circuit in Fig. 2 is Known as a Single-Circuit Regenerative Receiver. It Consists Mainly of a Vario-coupler, the Rotor of Which is Employed as a "Tickler Coil," Controlling the Regeneration. A Series-Parallel Switch is Employed. So That the Variable Condenser Can Be Connected in Series with the Tuning Coil for Short Waves, in Parallel with the Coil for Long Waves, or Out of the Circuit for Reception on Intermediate Waves. The Variable Condenser "C" is Optional.





The Circuit of Fig. 3 Will Not Give Quite the Same Amount of Signal Strength as That of Fig. 2. However, it is Much More Selective. It Employs a Standard Honeycomb Coil Mounting and Three Honeycomb Coils. Tuning is Accomplished by Varying Condensers C1 and C2, and Adjusting the Coupling Between the Primary and Secondary Coils. Regeneration is Controlled by Adjusting the Coupling Between the Tickler and Secondary Coil. Again, a Series Parallel Switch is Employed so That All of the Broadcast Wave-lengths Can Be Covered.

The Circuit of Fig. 4 Combines Selectivity and Sensitivity. Tuning is Accomplished by Varying the Amount of Wire in Use on the Primary Coil of the Vario-coupler. Adjustment of the Variable Condenser across the Secondary Coil and the Coupling Between These Two Coils. Regeneration is Controlled by the Variometer in the Plate Circuit of the Vacuum Tube. The Fixed Condenser "C" May Be Placed in the Circuit by Closing the Switch, for Reception on the Higher Wave-Lengths. The Switch Should Be Opened When Receiving on the Lower Wave-Lengths.



$200.00 Single Tube Radio Contest

DATE OF CLOSING EXTENDED TO NOVEMBER 15th, DUE TO LACK OF RESPONSE BY OUR READERS. DO YOU OR DO YOU NOT WANT REAL MONEY FOR YOUR EXPERIMENTS? BETTER GET BUSY—THERE ARE 10 PRIZES IN GOLD.—EXTENSION OF TIME AGREED TO BY CONTESTANTS ENTERED TO DATE.

SIMPLICITY in radio is becoming more and more the goal of all radio experimenters. There is no doubt that in radio the vacuum tube rules the land at the present time. There have been described many hundreds of different single tube hook-ups, but we believe that somewhere one will be found superior to what has appeared so far.

In order to locate it, we are willing to pay prizes to the ones who can show us the *best "single tube" hook-ups.* It makes no difference whether the hook-up submitted to us is of the regenerative type, a reflex, radio frequency, and detector or any combination of the three—or, for that matter, something entirely new.

With a single tube hook-up, as, for instance, a super-regenerative, it is possible to pick up radio concerts from over 1,000 miles and more—and concerts have been reported as coming in on a loud talker from such a distance.

Then there are other hook-ups which do not reach so far, that are better for local work, and bring in the sounds with a great volume, on a loud talker.

It seems that at the present time the public really wants something that is simple and that brings in the sounds loudly from local stations, rather than covering great distances with a pair of head receivers.

The judges, therefore, will have their eyes open for long distance hook-ups, or short distance hook-ups that can be used best with loud talkers.

As will be seen in our list of prizes, there are two series—one for the long distance "DX" types, and for the short distance "loud talker" types. The best of each group will get similar prizes.

The sets that the prizes go to should be easily tuned, and there should be a minimum of interference for the sets of each group.

Furthermore, the judges will look out for the set of the greatest simplicity. Naturally the more apparatus employed and the more complicated the set is, the smaller will be the chances for a high prize. The high prizes will therefore probably go to those sets having the simplest circuits, with a minimum of apparatus contained therein.

The following rules must be observed:

RULES FOR SINGLE TUBE CONTESTS

Not more than one vacuum tube can be used.

FIRST PRIZE
"DX" SET, $50.00 in gold.
"Loud-Talker" Set, $50.00 in gold.
SECOND PRIZE
"DX" Set, $20.00 in gold.
"Loud-Talker" Set, $20.00 in gold.
THIRD PRIZE
"DX" Set, $15.00 in gold.
"Loud-Talker" Set, $15.00 in gold.
FOURTH PRIZE
"DX" Set, $10.00 in gold.
FIFTH PRIZE
"DX" Set, $5.00 in gold.
"Loud-Talker" Set $5.00 in gold.
Total, $200.

Any vacuum tube may be used, whether using two or three elements or more. Dry battery tubes, or storage battery tubes, can be used at the designer's option.

The circuit (the arrangement and layout of the parts) should be different from anything that has appeared in print heretofore or else some new feature should be embodied in the outfit, that has not been used or published previously.

It is absolutely necessary that the circuit or hook-up has been actually used in practice, as mere ideas are not eligible in this contest.

As a proof of this, all contributors must submit their outfits to the editors, who will test the outfits themselves, under the usual conditions, and will be guided by the performance of the outfit in awarding the prizes.

A manuscript of not more than 750 words should accompany the outfit.

Where standard instruments, such as condensers, tubes, etc., are used in assembling the circuit, they should be individually named in the manuscript.

A good diagram of the connections, well executed in ink, must be furnished.

A photograph of the builder is also required.

All outfits, photographs, diagrams and other data, sent in by contestants, which have not been used by the publishers, may be returned at the publishers' own expense.

Outfits are to be sent by Parcel Post or Express, Prepaid. Expenses for such transportation both ways will be refunded by the publishers.

All models or outfits will be promptly returned to the builders.

More than one outfit may be entered by contestants.

The contest is open to every one, radio club members included, except manufacturers of radio apparatus.

All prizes will be paid upon publication.

Where two contestants submit the same prize-winning idea (constituting a tie), the full prize will be paid to each.

This contest closes in New York on November 15th, midnight, and the first prize-winning article will appear in the February, 1924 issue.

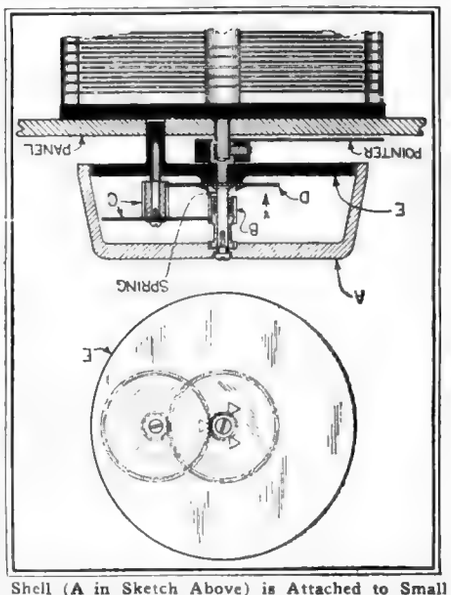
Address all outfits and all correspondence pertaining to this prize offer to *Editor, Single Tube Prize Contest,* in care of this publication.

Loud Speaker Horn

The Natural Acoustics of This Sea Shell Combined with Its Small Size Make It a Wonderful Loud Speaker Horn. The Tone Is Clear and Loud and the Volume Big, According to the Ar[illegible] City Amateur Who Uses It.

Vernier Adjustment for Condensers

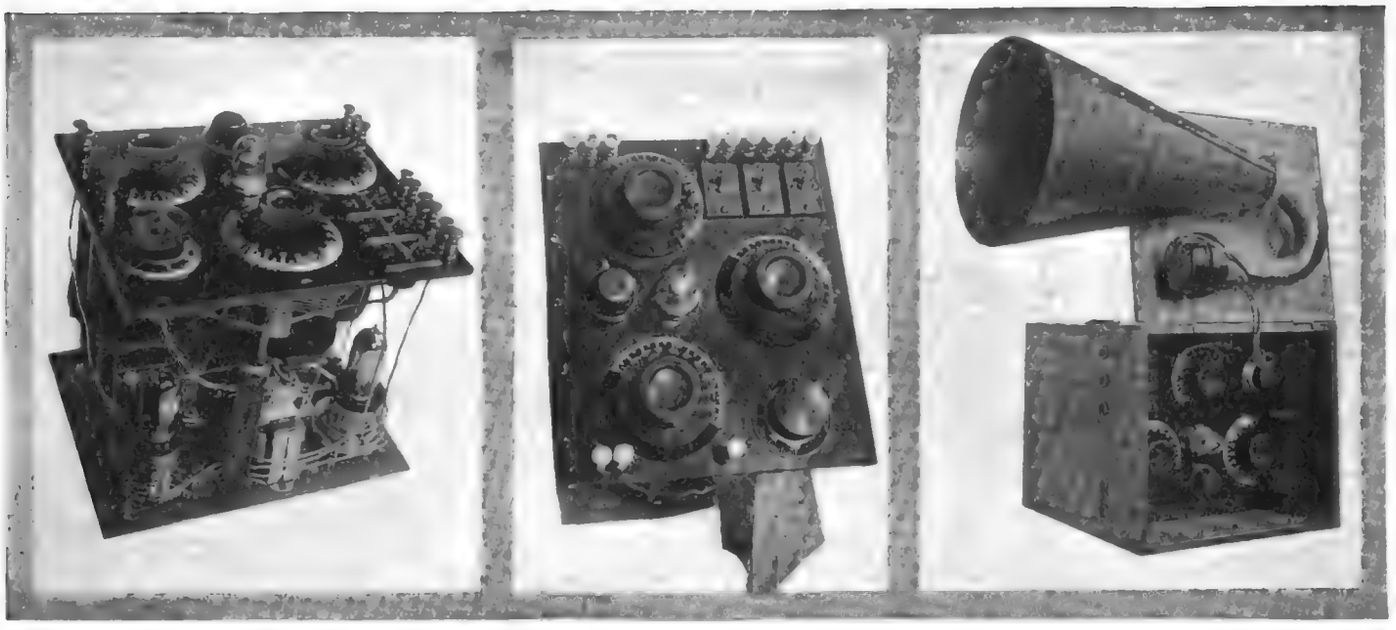
Tune for DX and CW Stations on the Same Condenser! A New Adjusting Knob, Known as the Univernier, Has Just Been Brought Out with Which it is Possible to Make a Closer Selection with a Regular .001 or .0005 Variable Than with the Use of a Vernier. By Means of Gears Inside the Knob Its Movement is Reduced Eight Times Making the Fine Tuning Possible. For CW Stations Slip the Knob in and It Works Directly to the Condenser Shaft Giving Broad Tuning and Quick Adjustment. Photo (Above) Shows Special Dial Graduated to Single Degrees for Use With the Fine Tuning.



Shell (A in Sketch Above) is Attached to Small Gear (B) Which Turns Reducer (C) Attached to Base (E) Which in Turn Works Second Reducer (D). A Spring Holds Shell Gear in Mesh. When It is Slipped in Gears Are Disengaged and It Works Shaft by Meshing Prongs on (D).

A Special "Reflex" Amplifier

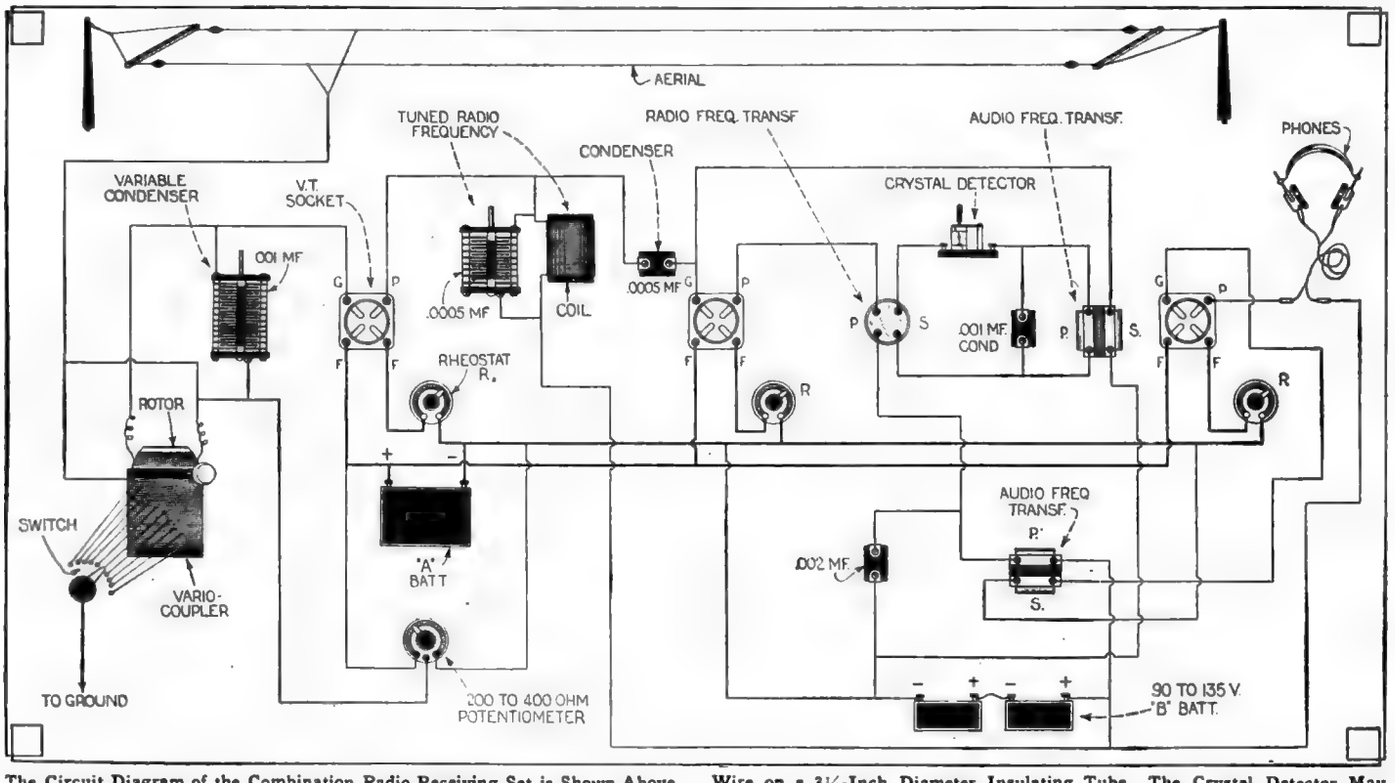
By R. B. HALL



A Top and Side View of the Compact Reflex and Straight Amplification Radio Receiving Set, As it Appears Without the Cabinet.

A Front View of the Same Set, Showing the Relative Positions of the Controls and the Crystal Detector.

The Combination Receiving Set Placed in Its Cabinet, Showing Its Size in Comparison with a Standard Type of Loud Speaker.



The Circuit Diagram of the Combination Radio Receiving Set is Shown Above. This Circuit Gives Excellent Results on Both Long Distance and Local Reception and is Comparatively Easy to Control. The Tuned Radio Frequency Choke Coil is Made by Winding Approximately 45 Turns of No. 20 D. C. C. Wire on a 3½-Inch Diameter Insulating Tube. The Crystal Detector May be of Any Type Desired, Although it Should Be Rather Rugged in Construction and Should Use a Crystal Capable of Passing Quite a Large Current. An Erla Radio Frequency Transformer is Recommended by Mr. Hall.

250,000 COPIES

is a tremendous figure for a radio publication. Nevertheless, just this many copies have been printed of the October issue of RADIO NEWS, America's greatest radio magazine.

Month after month some of the foremost radio men throughout the world contribute to the columns of RADIO NEWS. ARTICLES by well-known Scientists such as Sir Oliver Lodge, Dr. J. A. Fleming, Dr. Lee de Forest, Eugene Nesper (Berlin), and John Scott Taggart (London), will be found regularly in RADIO NEWS.

SOME OF THE INTERESTING ARTICLES APPEARING IN THE OCTOBER ISSUE OF RADIO NEWS

Pioneer Work in Ether Waves,
By Sir Oliver Lodge.

Experiments with the ST-100 Circuit,
By John Scott-Taggart.

Radio Frequency Amplifiers,
By Louis Frank.

Electrons, Electric Waves and Wireless Telephony,
By Dr. J. A. Fleming.

The Galena Amplifier,
By Clyde J. Fitch.

A Capacity-Coupled Receiver,
By Paul G. Watson.

Construction of Push-Pull Transformers,
By H. N. Bliss.

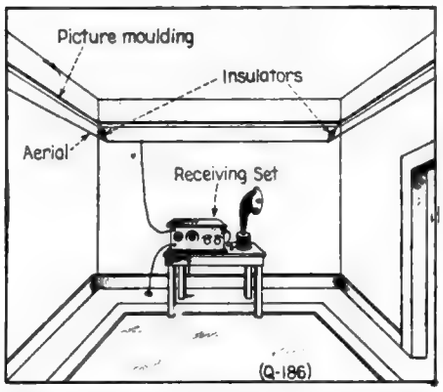
Radio Oracle

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 25c is made for all questions where a personal answer is desired.

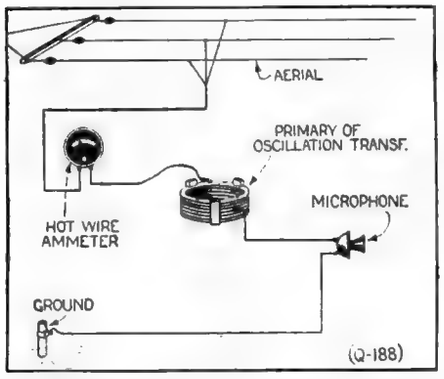
INDOOR AERIAL

(186) Jack J. Jones, Summit, New Jersey, asks:

Q. 1. Should an indoor aerial, which is run around a room and suspended from the picture moulding be insulated?



One of the Best Locations for an Indoor Antenna is Illustrated Above. The Insulators Are Not Necessary, but Will Give Somewhat Better Results in Damp Weather.



A Microphone Inserted in the Ground Lead of a Loose-Coupled C.W. Transmitter, Will Allow the Transmission of Radiophone Messages. This Method is Satisfactory Only Over Short Distances.

A. 1. It would be best to suspend such an aerial as illustrated in these columns.

THE BEST ANTENNA

(187) Philip T. Brown, Portland, Maine, wants to know:

Q. 1. How can I construct the most efficient aerial, regardless of cost, for receiving on wave-lengths of 600 meters and up?

A. 1. The illustration in these columns shows the best possible type of antenna for such work.

PHONE TRANSMITTER

(188) Walter Baumgartner, Manchester, Iowa, says that he has a single tube C. W. transmitter, with an inductively coupled tuner, and asks:

Q. 1. How can I convert this into a radiophone transmitter?

A. 1. The circuit diagram in these columns shows the method of connecting the microphone. The transmitting key must be closed when the set is used for radiophone transmission.

CRYSTAL HOOK-UP

(189) Walter Biehl, Porterfield, Wisconsin, asks:

Q. 1. How can I hook up a variometer, a two slide tuning coil, and a crystal detector?

A. 1. The diagram given herewith shows the necessary connections.

Q. 2. How can I use a lightning switch on this set?

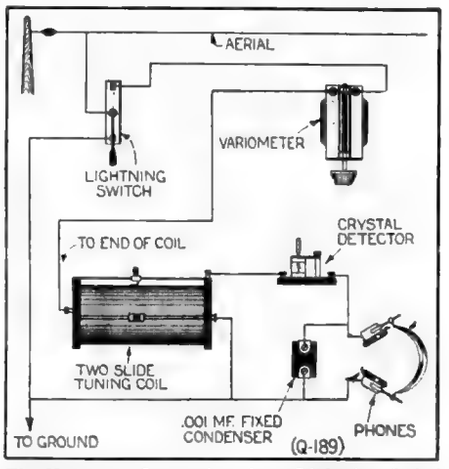
A. 2. This is also indicated in the diagram.

RADIO FREQUENCY SWITCHING ARRANGEMENT

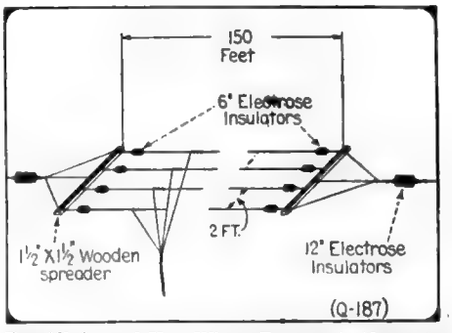
(190) H. C. Fulson, Memphis, Tennessee asks:

Q. 1. How may two stages of radio frequency amplification be connected with an audion detector, and switches used to eliminate the first two tubes when desired? Two variocouplers are to be used.

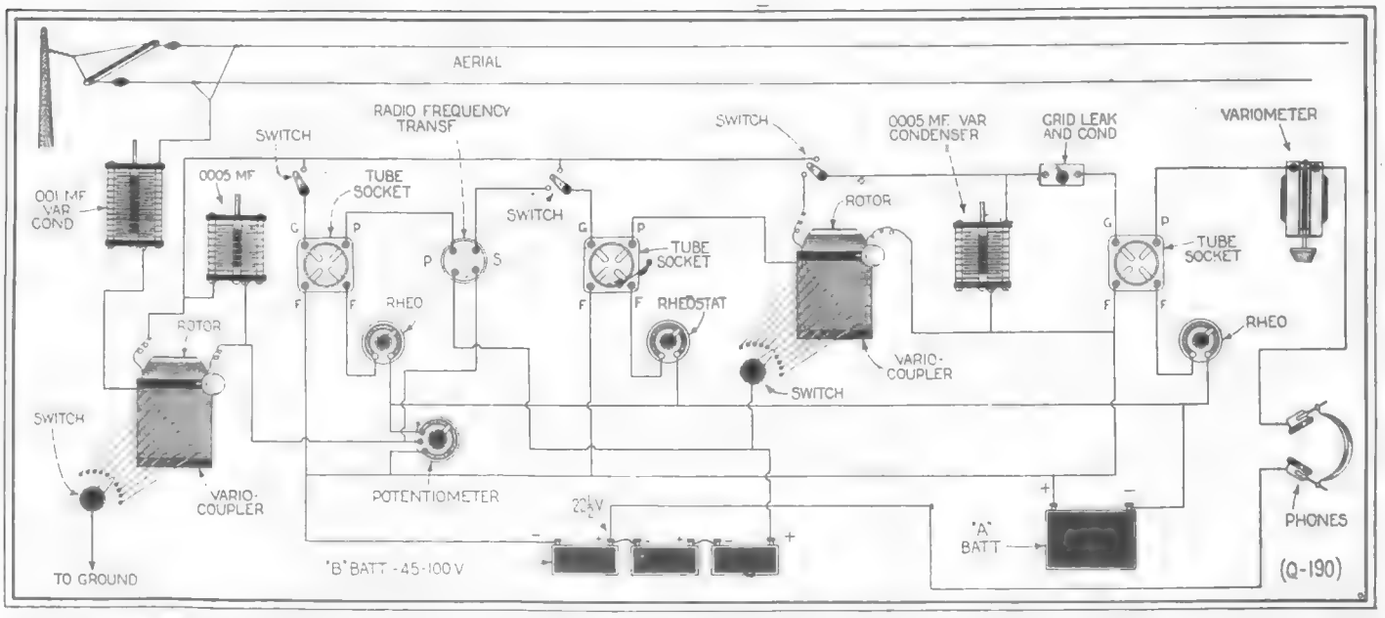
A. 1. The necessary connections are shown at the bottom of this page.



The Necessary Connections for a Lightning Switch Used with a Crystal Receiving Set Are Shown Above. The Variometer Will Allow Reception on Higher Wave-Lengths.



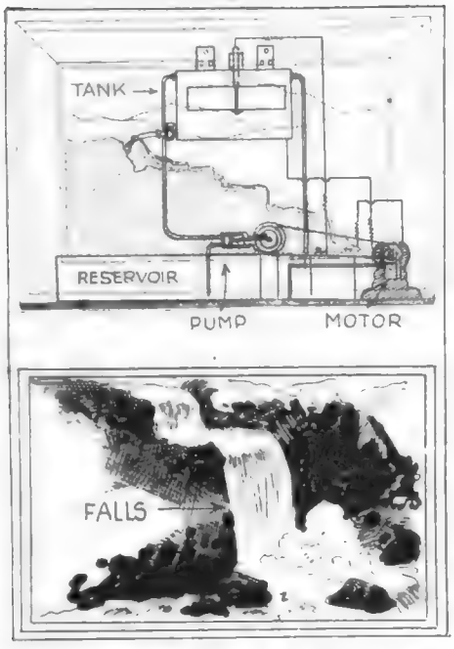
For All Around Use, Where Expense is Not to be Spared, an Aerial Built as Illustrated Above Will Give Excellent Results for Reception. It Should Be Located as High as Possible.



An Excellent Circuit for Tuned Radio Frequency Amplification is Given Above. By Means of the Two 2-Point Switches and the Single-Point Switch, It is Possible to Use One or Two Stages of Radio Frequency Amplification or Both Eliminated and the Detector Used Alone. The First Stage of Amplification is Through a Transformer While the Second is Tuned with a Vario-Coupler. Regeneration is Accomplished in the Detector Only by Use of the Tuned Grid and Plate Circuits. The Potentiometer is Essential in This Circuit for Best Results. Standard Instruments Should Be Used.

LATEST PATENTS

Animated Picture

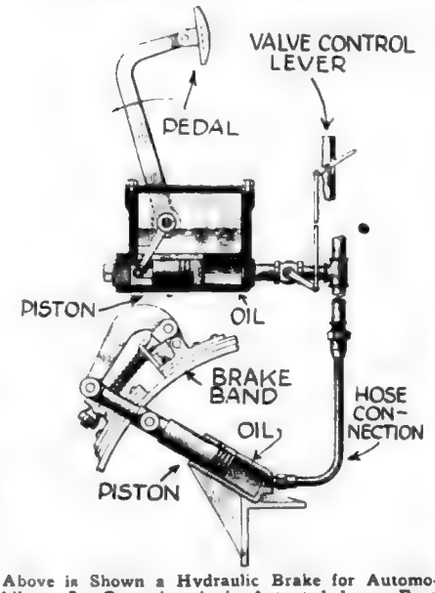


The Usual Deadness of Pictures is Obviated Here by Use of Bas-relief Around the Waterfall, a Tank Above and Below Allowing the Pictured Fall to Become a Real One. A Motor-pump Raises the Water From the Bottom to the Top Tank, Where it is Used Again.

MASSAGING DEVICE

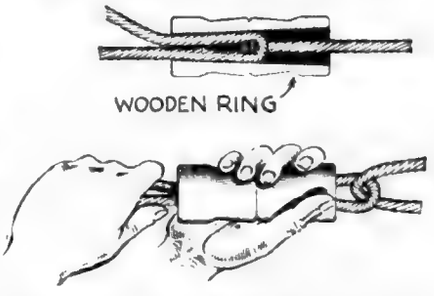
Take Your Morning Massage on the Way to Work! With this Little Vacuum Massaging Device That can be Carried in a Hand Bag the Need of Waiting in the Beauty Parlor is Obviated. Just Press the Handle and You Have a Perfect Vacuum Massage.

Hydraulic Brake



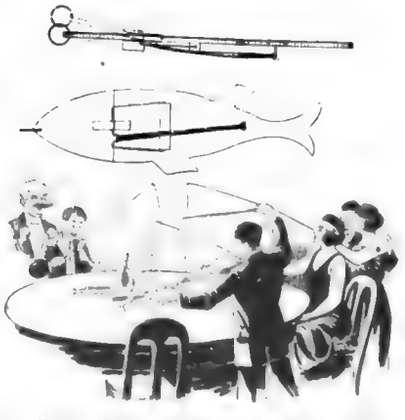
Above is Shown a Hydraulic Brake for Automobiles. In Operation it is Actuated by a Foot Pedal. The Whole System is Automatically Vented So That Air That Might Collect in the Cylinders is Released and its Cushioning Effect Destroyed.

CLOTHES-LINE KNOTTER



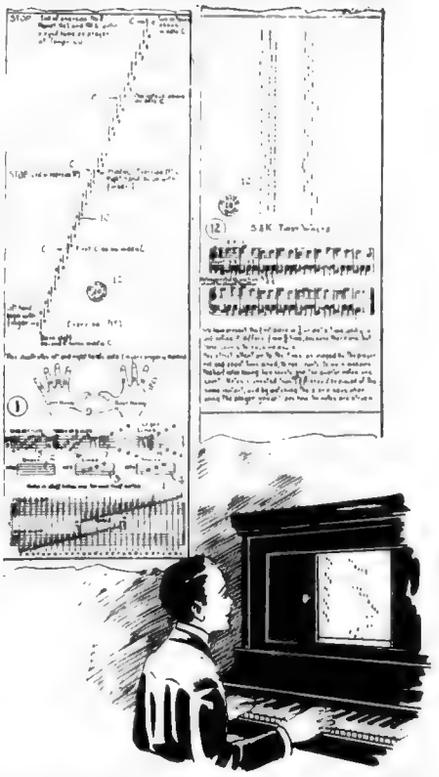
There is no Longer any Necessity for Doing Acrobatic Stunts Out the Window in Order to Fasten the Clothes Line. Note the Idea in the Patent Shown Above. Just Slip the "Handle" on the Line, Make a Loop, Pass the Other Loose End Through and Loop, and Pull the Handle Up.

FISH-POND GAME



This Game Gives, Almost, the Real Thrill of Fishing. With the Aid of the Rubber Band, When the Fish is Hooked, Taking the Curve Out of its Spine, it Flies High into the Air, Eluding the Fisherman's Hook. Score by the Fishes Successfully Caught.

Piano Self-Taught



Here is Shown a Simplified Method of Teaching Piano With the Aid of a Player-piano. All Connotations are Written on the Roll. It is Only Necessary for the Student to Give the Written Lesson His Attention and Place His Fingers on the Keys Depressed.

CHAIN FIRE ESCAPE

This Novel Fire Escape, Constructed of Cable and Chains Has the Advantage of Allowing a Large Number of Persons to be Rescued from a Burning Building at One Operation, With the Minimum of Danger to Both Firemen and Victims.

Scientific Humor

Blood Curdeling—During a lecture at Yale, Professor AUGUST KROGH, of Copenhagen, announced that if the blood-vessels of the average man were placed in a straight line they would encircle the globe two-and-a-half times. The chief drawback, it seems, is the great difficulty of getting them back into their proper position again.—*Punch, (London)*.

They Affect OUR Pocketbook—"Do wireless waves in any way affect living creatures?" asks a correspondent in a contemporary. A henpecked husband writes to say that since he bought a listening-in set he has at last found peace.—*Humorist, (London)*.

Clever Animals—At a table in a certain boarding-house a student boarder, who had been reading the scientific notes in a publication on a side table, remarked:—

"More than five thousand elephants a year go to make our piano keys."

"My land!" exclaimed the landlady. "Isn't it wonderful what some animals can be trained to do!"—*MacLean's Magazine*.

Stung!—In a scientific article it is stated that only two colors, blue and yellow, are visible to bees. This is contrary to the popular belief that, on occasion, they see red.—*Punch (London)*.

My Stars!— "My dear," said the newly married man to his wife, "where did all these books on astronomy come from? They are not ours."

"A pleasant little surprise for you," remarked his wife. "You know, my dear, you said this morning that we ought to study astronomy; and so I went to the bookseller's and bought everything I could on the subject."

It was some minutes before he spoke.

"My dear," he said then, his voice husky with emotion, "I never said we must study astronomy; I said we must study economy."

Tit Bits (London).

A Large Order — CUSTOMER —"Do you make life-size enlargements from photographs?"

PHOTOGRAPHER —"Yes, sir; that's one of our special lines."

CUSTOMER — "Well, do one of this for me. It's a snap I took of a whale."—*Bulletin (Sydney)*.

A Light (English) Joke—During a recent thunderstorm the lightning is said to have caused the signal lights on telephone switchboards to glow as if subscribers were calling. We are "sorry" the operators were disturbed.

Some Speed!—An airplane from London to Hythe (60 miles) reached its destination several minutes before the telephone message announcing its departure was received at Hythe. Perhaps the aeroplane was delayed by [illegible] trouble.—*Humorist (London)*.

Why the Editor Fled—The bolt of lightning came down between Mrs. Carney and her sister, and ripped off a good deal of plaster.—*From an account of a storm in the Hudson, New York, Evening Star.*

Or Go To The Movies—"Who is Thomas A. Edison?"

"He's the man that invented the phonograph to keep us awake, so we would stay up all night using his electric lights."

—*Judge.*

Sure—No Ash Sifter Journals!—"Your husband is handy with tools, isn't he?"

"Well, he can fix a stubborn radio apparatus," said Mrs. Wijjit, "but he can't repair an ash sifter."—*New York Sun.*

"SCIENTIFIC HUMOR," which for several years ran successfully in SCIENCE AND INVENTION, *is beginning anew in this issue.*

We have compiled on this page a number of jokes in which the scientific element is present. Look these over carefully before you send in your contributions. We have shown on this page scientific humor from all parts of the world, but we believe our readers will have no trouble in matching these humorous outbursts, and in many cases "outburst" them!

All contributions must be scientific in order to get attention. Do not copy jokes from old books or other publications as they will not be accepted. Write each joke on a separate sheet of paper and sign your name and address to it. Write only on one side of the sheet. Letters cannot be acknowledged unless return postage is attached. For each joke published, the contributor will receive $1; *there is also a first prize of* $3 *for the best one submitted each month. In the event two people send in the same joke tying for the prize, each will receive the amount of the prize.*

S-TUT-TUT—She had sent off a telegram and was waiting for an answer. Suddenly the halting click of the receiving machine sounded in the office, and she said to her companion:—

"That's from Harry; I can tell his stutter."—*Tit Bits (London)*.

When the Lightning Struck—"Ever get shocked talking over the telephone during a storm?"

"Yes, once. I called up my wife while she was housecleaning to say that I'd bring a friend home to dinner."—*Boston Transcript.*

A Loose Connection—"Great Scot, Harris, how did you get down here?"

"By wireless, you idiot. Can't you see?"—*Passing Show (London)*.

Should Have Sold 'Em For Ground Rods!—"I suppose you cleared a fortune peddling lightning rods around the country this summer?"

"Couldn't interest a single farmer. They all had their roofs covered with radio aerials."—*Judge.*

Why They Flunked—Among recent schoolboy examination "howlers" we choose the following:

"Parallel lines are the same distance all the way and do not meet unless you bend them."

"Gravitation is that which if there were none we should all fly away."

"Horse power is the distance one horse can carry a pound of water in an hour."

—*The Christian Evangelist (St. Louis)*.

She Took To Him — "Who is the girl you just greeted?"

"I made her acquaintance during my last air voyage—air ship fell down—so I offered her the use of my parachute."

—*Fliegende Blaetter (Munich)*.

Righto!—Engel much interested in science, returns home after attending lecture on radio telephony.

"Just think Fischel that it is possible to speak from America to Europe by Radio"

"Well that is nothing extra!"

"What! Talking across the ocean without our wires and poles is nothing extra!"

"Sure not. If they could put telegraph poles with wires across the ocean, that would be something to crow about."

—*Lustige Blaetter (Berlin)*.

Nosed Out—TEACHER TO THE CLASS—"Does any one know how iron was discovered?"

PUPIL—"Yes, sir."

TEACHER—"Well, tell this class your information."

PUPIL—"Please, sir, they *smelt* it."—*Hollywood High School News.*

We Want One —*Optimistic Inventor* (Soliloquizing after smash) — Still, that gives me a splendid idea—a folding car!—*Passing Show (London)*.

Solid Ivory—PROFESSOR: "What is a transparent body?"

"A transparent body is—is—is—"

PROFESSOR: "Is a body thru which one sees light."

"Thank you professor."

PROFESSOR: "Since you have not been able to give me a definition, give me an example."

"A key hole."

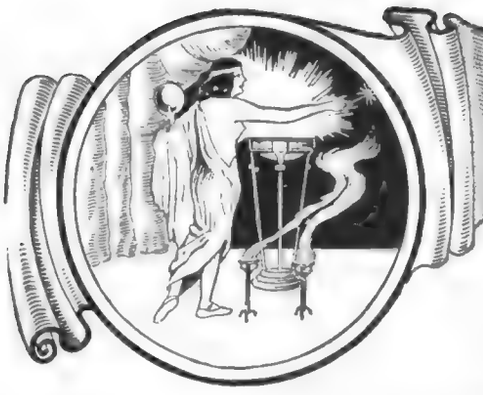
PROFESSOR: "Key hole! How so?"

"Because you can see the light through a key hole."—*Le Petit Journal (Garden City)*.

An Eye Full—"What are you studying now?" asked Mrs. Johnson.

"We have taken up the subject of molecules," answered the son.

"I hope you will be very attentive and practice constantly," said the mother. "I tried to get your father to wear one, but he could not keep it in his eye."—*Columbia Jester.*



THE ORACLE

The "Oracle" is for the sole benefit of all scientific experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to the department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

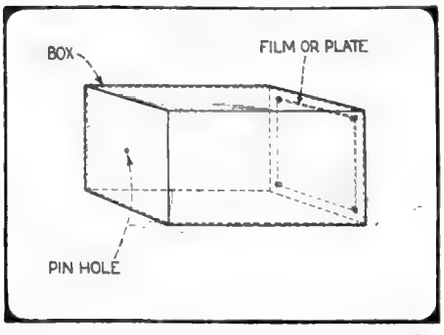
PIN HOLE CAMERA

(1540) J. B. Pinkos, Pittsburgh, Penna., asks:

Q. 1. How may a pin hole camera be made?

A. 1. The construction of a pin hole camera is extremely simple and its finished appearance is shown herewith. The construction is as follows.

Make a box of either cardboard or light wood,



In the Pin-hole Camera Shown Above the Size of the Exposing Opening Will Have to be Determined by Experiment, Also Exposure Time.

of about the shape shown, and with ends slightly larger than the film which is to be used. One side of the box should be on hinges so that the film can be readily placed within or removed. Next paint the inside of the box black and in one end, punch a hole with a thin needle. The size of this hole will have to be determined by experiment.

Now in a dark room, place a film in the end of the box opposite the pin hole and hold it in place by means of any type of wire or spring clips which may be desired. Close up the box so that all light will be excluded therefrom and cover up the pin hole. Take the camera into a good strong light and make the exposure. The length of this exposure will have to be determined by experiment and is controlled by uncovering the pin hole for the desired length of time and then covering it up again. Be careful not to shake the camera while the exposure is being made.

ARTICLES ON ELECTRICITY FROM THE AIR.

(1541) O. Godrich, Jacksonville, Fla., asks:

Q. 1. What material have you ever published on the extraction of electricity from the atmosphere and from natural forces, also on work done in overcoming gravitation.

A. 1. Many issues of this magazine have contained some form or other of articles dealing with one or the other subjects you mention.

However, we are giving you below a list of feature articles on these subjects.

Power From the Air.....Mar., 1922
Electric Power From the Sun.....Apr., 1922
Electricity From The Wind.....Jan., 1922
Overcoming Gravitation.....Mar., 1920
New Researches in Gravitation.....Mar., 1920
Gravity Defied.....Jan., 1922

All these issues may be obtained from our Subscription Department at 25 cents each.

PHOSPHORESCENT LAMP

(1542) Robert S. Graham, Beaver Falls, Penna., says that he has several times seen mention of a lamp which glows continuously consisting of a small pill bottle with chemicals inside. He asks:

Q. 1. Can you tell me where any such lamp has been described and if possible tell how to make one?

A. 1. The lamp you mention has been described once or twice in the pages of this magazine, but it does not seem to give very good satisfaction. The writer constructed one, but it did no more than glow, giving forth practically no light whatsoever.

The method was as follows. Obtain a small pill bottle, and enough olive oil to fill the same about two-thirds full. Heat the olive oil almost to its boiling point, and pour into the pill bottle. Drop therein a small piece of phosphorous about the size of a pea, allow the oil to cool, and cork the bottle. It will be found necessary to uncork the bottle at various intervals in order to re-establish the glow. Care must be taken in handling the phosphorus to see that it is kept under water at all times up to the point when it is transferred to the oil.

FIRE EXTINGUISHERS

(1543) J. H. Geelmuyden, Lynchburg, Va., asks:

Q. 1. Is carbon tetrachloride a good fire extinguisher and in what way may it be used for this work?

A. 1. Carbon tetrachloride is an excellent fire extinguisher, which work it does by virtue of the gas given off which extinguishes the flames. This material is used in a well known make of fire extinguisher, and the resulting gas is by no means harmful to human beings. If the carbon tetrachloride is contained in sealed glass containers, they should be thrown at the worst part of the fire with a force sufficient to break the glass. Carbona is practically the same thing and makes a good fire extinguisher.

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers only with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. For your convenience, we are appending herewith a blank which we ask you to be good enough to fill in and hand to your newsdealer. He will then be in a position to supply copies to you regularly every month. If you are interested in receiving your copy every month, do not fail to sign this blank. It costs you nothing to do so.

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TRANSLUCENT METAL

(1544) Felix Grandich, Bronx, N. Y., asks:

Q. 1. Is there any metal which can be made translucent and if so, how?

A. 1. The only way to obtain a translucent metal, is to beat or press the same into very thin sheets. Gold, silver and platinum are the only metals which lend themselves to this process. Gold leaf is a very good example of translucent metal. Some of the rarer metals can also be beaten thin enough to become translucent.

WIND-DRIVEN ELECTRIC LIGHT SYSTEM

(1545) Oscar Peterson, Worthing, So. Dak., refers to an article in the February issue of SCIENCE AND INVENTION on how to make a wind-driven electric lighting system and asks:

Q. 1. Can this lighting system be used to charge a six volt storage battery?

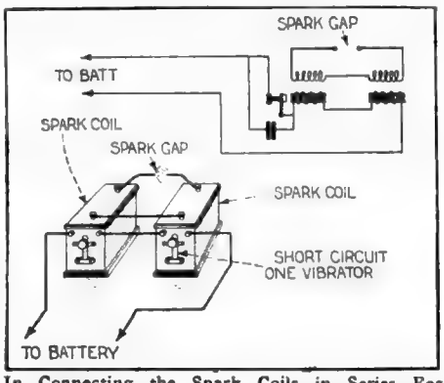
A. 1. You may very easily utilize the wind-driven power plant you mention for the charging of a storage battery, in fact, such a use was suggested in the article. An automobile generator is particularly adapted to such use.

SPARK COILS IN SERIES

(1546) C. P. Sullivan, Johnsonburg, Penna., wants to know:

Q. 1. How can I procure a longer spark from a spark coil, by connecting to it another spark coil of the same size?

A. 1. You may procure the spark length of both of your spark coils by connecting the primaries in series with each other and in series with the battery, also connect the secondaries in series as illustrated herewith. Use but one vibrator.



In Connecting the Spark Coils in Series For a Fatter and Longer Spark, as Shown Above, Short-Circuit One of the Vibrators, as Shown.

REMOVAL OF HAIR ELECTRICALLY

(1547) J. F. Price, El Pasco, Texas, asks:

Q. 1. How is hair removed from any part of the body by electrolysis?

A. 1. In the electrolysis method of removing hair, one electrode, connected to a six volt storage battery, is held in the hand, and the other is connected to a sterilized needle. The latter is inserted into the skin at the root of the hair, until a small white drop of fluid exudes from the base of the hair.

At this time it will be found that the hair can be easily removed and will never return. This method is very slow as it is necessary to remove one hair at a time, and is, unless practised by a competent operator, rather dangerous.

CALCULATING TRANSFORMER DESIGNS

(1548) Fred S. Orpen, Toronto, Canada, requests:

Q. 1. What is the formula for obtaining the number of turns in the coils of a step-down transformer? For example, if the primary were designed for 110 volts with 500 turns wound thereon, and you required a 12 volt secondary, how would you calculate the number of turns in the latter?

A. 1. When the number of turns in the primary of a step-down or step-up transformer has been determined, the number of secondary turns for a particular voltage is very easily found. This equation is used. The number of turns on the primary is to the primary voltage as the number of turns on the secondary is to the secondary voltage. Three of these are known and by simple mathematics the fourth one may be found.

THE THALOFIDE CELL.

(1549) T. K. Peters, Los Angeles, Calif., asks:

Q. 1. How may I make a sensitive photo-electric cell such as that known as the Thalofide cell?

A. 1. We will send upon receipt of a stamped addressed envelope the name of the manufacturer of the Thalofide cell. However, you will not be able to purchase any of the material used in the cell as it is manufactured under a secret process and must be made as it is to be used and placed immediately in a vacuum as otherwise its photo-electric properties will be destroyed.

PHOTO ELECTRIC CELLS

(1550) Vernon F. Bradley, Decatur, Ill., says that he has seen mention in this magazine of a photo electric cell much more sensitive than a selenium cell. He asks:

Q. 1. Can you tell me where I can purchase a book dealing with the construction of these cells or give me this information through your Oracle Department?

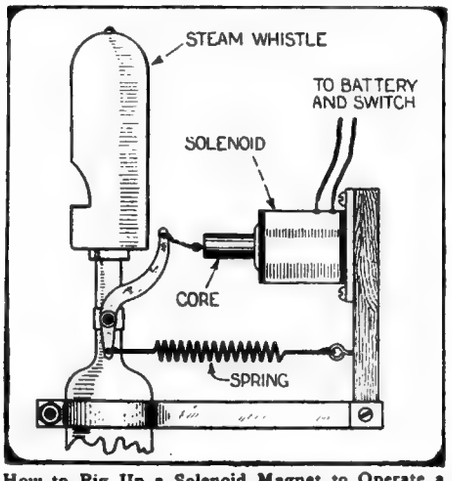
A. 1. All cells which depend for their action upon light, are called photo-electric cells, therefore, selenium comes under this head, as does the Kuntz and the Thalofide cell. We do not believe that you can obtain a book giving instructions for the making of these very sensitive cells as it requires a full laboratory equipment including a vacuum pump. If you wish to get a further insight into the manufacture of these cells, you should write to the Patent Office at Washington, D. C., and request a copy of patent No. 1,316,350, enclosing 10c. in cash.

ELECTRICALLY OPERATED WHISTLE

(1551) Wilbur E. Allen, Monticello, Ill., asks:

Q. 1. How may I operate a steam whistle by means of a solenoid from a point remote to the whistle?

A. 1. You may obtain the result you desire by constructing a lay-out similar to the one illustrated herewith. This consists of a solenoid which pulls a bar fastened to a lever, which in turn operates the whistle. The solenoid is connected through a switch to the 100-volt line. Not knowing the force required to operate the whistle, nor any other definite data, we are unable to tell you what size solenoid to use, but would advise you to experiment until you find the best size.



How to Rig Up a Solenoid Magnet to Operate a Steam or Compressed Air Whistle.

HECTOGRAPH COMPOSITION

(1552) Anthony Azzopardi, New York City, asks:

Q. 1. How is the composition used in a hectograph or duplicating pad made?

A. 1. We are giving you the desired information herewith. Add 3 ounces of water to 1½ ounces of white glue. Heat in a double boiler until the glue is melted, then add 6 ounces of glycerin and pour into a shallow pan. If the resulting composition upon solidifying is too hard, add more glycerin, and if it is too soft, add more glue. It will be necessary to remelt the composition in the double boiler before making any such additions.

Q. 2. What kind of ink is used in connection with this device?

A. 2. The ink to be used with this composition may be made by dissolving one dram of purple aniline in 1 ounce of water.

ROMAN VITRIOL AND LIQUID NITROUS OXIDE

(1553) Mr. J. S. Babin, North Adams, Mass., wants to know:

Q. 1. What is roman vitriol?

A. 1. Roman vitriol is nothing more than copper sulphate, ($CuSO_4$).

Q. 2. Can nitrous oxide be liquified?

A. 2. It is entirely possible to liquify nitrus oxide, by applying a heavy pressure.

HEATING BATHS FOR CHEMICAL EXPERIMENTS

(1554) Mr. Robert Beidle, Barberton, Ohio, mentions a certain experiment in which a water bath is used for heating a particular substance whose boiling point is 248° F. He asks if it is possible to use a water bath in this particular case.

A. 1. We would advise you to either substitute a sand bath for the water bath in the experiment you mention, or else add a quantity of calcium chloride to the water, in which case the boiling point will be raised considerably. Either of these methods will give the results you desire.

MOTOR TROUBLE

(1555) Albert Barker, Goderich, Ont., Canada, says that he has a one-quarter horse-power motor designed to run on 110 volts A.C., which motor runs on the brushes until it gets up speed, whereupon the brushes are disconnected from the circuit. He says that this motor ran very well until recently, but now when the current is turned on a hum is produced, but the armature does not rotate. He asks:

Q. 1. Can you tell me what is wrong with this motor and give a few suggestions regarding the same?

A. 1. It may be that either your brushes are damaged or striking, or else some of your armature coils are burned out. We suggest that you dismantle the motor, and by inspection you can tell whether or not the trouble is with the brushes. This is the most likely place. We would suggest, however, that, unless you are well versed in such work, you send the motor back to the firm from whom it was purchased and have them do the repair work, as one uninitiated in this line might cause damage which would be expensive to rectify.

BATTERY CHARGING

(1556) Albert Barker, Goderich, Ont., Canada, asks the Oracle:

Q. 1. How many six volt storage batteries can be charged from an ordinary type of four-jar rectifier?

A. 1. Any one of the ordinary types of the four-jar rectifiers will charge as many as ten storage batteries, which should be connected in series. This applies to 6-volt batteries. The charging rate of the batteries will depend upon the batteries themselves. The charging rate should be about 1½ times the normal discharge rate, and the amount of current which passes through the rectifier, is determined by a bank of lamps used in series with the A.C. side of the same.

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NEW EXPERIMENTS BY THE DOZEN

And Innumerable Other

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including

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By O. E. Bricker

STORAGE BATTERY FOR DEMONSTRATIONS By Francis G. Le Iherie

NEW YORK'S ELECTRIC MAP.

HIGH VOLTAGE LABORATORY BATTERY By Harry R. Lubcke

THERMIC TELEPHONES.

LIVING ELECTRIC BATTERIES
By Harry Van Demark

INCANDESCENT GAS MANTLES

(1557) Louis Garna, New York City, requests:

Q. 1. Can you tell me how the materials applied to gas mantles are made?

A. 1. We are giving you the formula for the making of the treating mixture used in the manufacture of incandescent gas mantles.

Lanthanum oxide	3 parts
Yttrium oxide	2 "
Burnt magnesia	5 "
Acetic acid	5 "
Water, distilled	10 "

The oxides are dissolved in the acetic acid and water, and to the solution another 15 parts of distilled water are added and the whole filtered. The vegetable fibre (in its knitted or woven form) is impregnated with this solution, dried, and arranged on its support. In the formula the acetic acid may be replaced with dilute nitric acid. The latter seems to have some advantages over the former, among which is the fact that the residual ash, which is the working part, where acetic acid is used has a tendency to ball up and make a vitreous residue, while that of the nitric acid remains in powdery form.

ETCHING

(1558) Francis Gates, Healdsburg, Calif., asks:

Q. 1. How may materials such as brass, copper, iron and hard rubber be etched?

A. 1. Etching can be done on various kinds of metals by means of any acid which will attack that metal. This work has been discussed at various times in past issues of SCIENCE AND INVENTION.

For best results hard rubber should be engraved rather than etched, as it is by far the simplest way of obtaining any such results.

COPPER WIRE AS FUSE

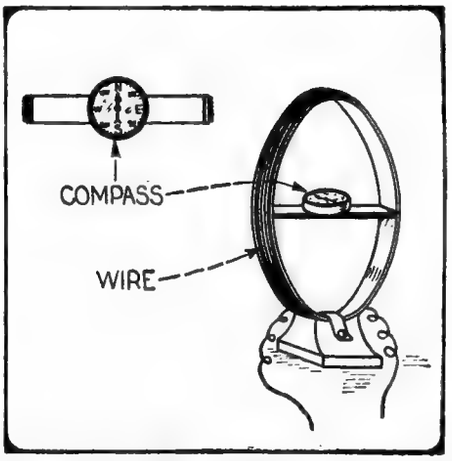
(1559) Edward Ayers, Deer Park, Wash., wants to know:

Q. 1. Can I use fine copper wire in place of fuses?

A. 1. Any size of copper wire will act as a good fuse; No. 34 wire answering the purpose you mention. It is necessary however, that the wire be rather short; otherwise, it takes too long for the current to heat the same to the melting point. That is the reason why fusible links are used in place of copper wire, because they will heat much more rapidly on an overload, and melt at a much lower temperature.

Q. 2. How can I make a galvanometer, using a magnetic compass in its construction?

A. 2. Winding a dozen turns of wire around your compass will make a very good galvanometer. A coil 5" in diameter with the compass placed on a shelf in the center, will answer your purpose admirably. No. 18 is a good size wire to employ.



Simple Way in Which to Construct a Galvanometer For Home Laboratory Use.

TRICK MIND READING

(1560) Alston Maxwell, Tulscaloosa, Ala., says that he has recently viewed a performance in a theater in which a lady sat at a piano on the stage and her assistant went among the audience. Spectators whispered to the assistant the name of the selection that they wished the lady to play as he leaned over toward them, and immediately the pianist would play the selection desired. Our correspondent believes that the actor who passed among the audience had a sensitive microphone concealed under his clothes, but is not sure as to how the connections were made to the lady on the stage. He asks:

Q. 1. Am I right in my assumption as to the microphone, and how can the circuit be completed?

A. 1. We believe that you are quite correct in assuming that the microphone was concealed beneath the actor's clothing. The matter of making the circuit from the actor in the audience to the actor on the stage was fully described in the December, 1921, issue of Practical Electrics, under the head of "The Haunted Violin."

In this method two metal strips were placed under the carpet and contact was made by sharp metal points, fastened to the heels of the actress' shoes.

ILLUMINATING ROTARY SIGN

(1561) J. K. Johnson, Corpus Christi, Texas, says that he has seen a rotating electric sign which appears stationary when illuminated by a peculiar type of bulb. He asks:

Q. 1. What are these bulbs and how is the effect produced?

A. 1. The bulbs you mention are those known as Geisler tubes, and the sign must be rotated at a speed equivalent to the frequency of the sparks passing through the Geisler tube.

EXPERIMENTAL ELECTRO-MAGNET

(1562) W. E. Allen, Monticello, Ill., asks:

Q. 1. How may I make an electro-magnet so that it will operate on 110 volts A. C.?

A. 1. The size of the wire used on your magnet will depend upon the size of the core and the amount of current you wish to draw. An experimental magnet may be constructed by winding 500 turns of No. 18 D. C. C. wire on a 1 inch iron core, 4 or 5 inches long. The core should be composed of a bundle of iron wires.

SOLDERING STEEL

(1563) A. J. Gibson, Philadelphia, Penna., requests:

Q. 1. How can I solder steel and what solution should be used?

A. 1. In soldering, it is necessary to heat both of the parts to be joined, thoroughly, to the melting point of the solder being used. A solution of zinc chloride in water may be used for soldering steel. Killed muriatic acid is used by plumbers and tinsmiths for all such soldering.

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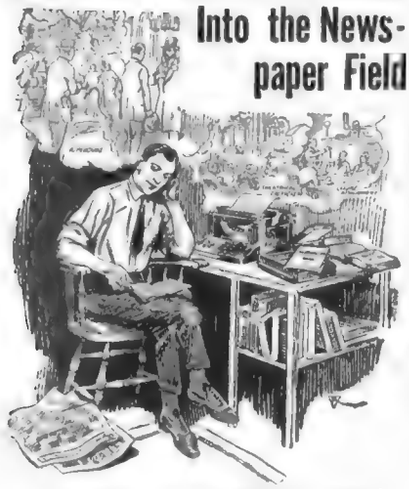

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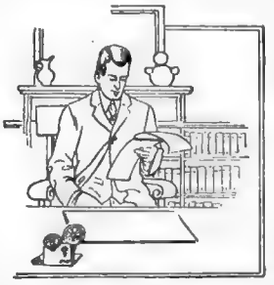
Pitfalls of the Radio Inventor

By EVERETT N. CURTIS.

(*Concluded from Sept. Number*)

Where the inventor is well acquainted with the art, he could very well in many cases dispense with such examination, and rely upon the Examiner after the case gets into the office to discover and cite adverse references if there are any. Even after the usual preliminary examination is made, it is quite



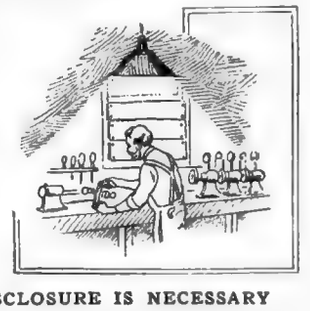
Be Sure to Read Carefully the Specifications Listed in Your Patent. If You Don't You May Be Granted a Patent on a Thing Entirely Different from the One You Invented. This Very Often Happens.

likely that the Examiner will in due course cite references not disclosed by it.

Such preliminary examination is, however, a safeguard, and in case the inventor is ignorant of the prior art, it is to be recommended as being of some value.

DATES ARE IMPORTANT

Another matter to be considered by the inventor is the importance of preserving the dates of his invention. If he obtains a patent and thereafter brings a suit, it may be advisable to show that he conceived his invention and reduced it to practice before the person who is claimed to be a prior inventor, or prior user, or author of a prior publication. Such proof may also be important should he be thrown into interference in the Patent Office during the prosecution of his application. No inventor's mere sayso, uncorroborated by other evidence, will be sufficient to establish the date of invention. There must be evidence of disclosures to others, drawings or writings, or the embodiment of the invention in some perceptible form. Memorandum books with dated and witnessed sketches and descriptions properly signed are often used to prove the date of conception. All inventors should have such books or memorandum sheets, and should carefully preserve them. As soon as the creative thought occurs to the inventor, he should record it in his memorandum book, and if possible should fully illustrate the same with sketches. When he has done this, he should sign his name, together with the date and place, and should have the same witnessed and signed by one or more witnesses. Letters written to some member of the inventor's family or to a friend, making the same disclosure, are also good evidence, particularly where the envelope showing the cancellation date of the post office is preserved. Probably the best evidence, next of a reduction to practice, is an affidavit with attached sketches certified to by a notary public, with his seal attached. But even the establishment of the first date of invention may come to naught unless the inventor is shown thereafter to have been diligent in reducing his invention to practice. The inventor should, therefore, be prompt in trying out his invention in some practicable form; his work must be promptly finished physically as well as mentally. If he waits too long between conception and reduction to practice, some other inventor who may independently conceive the invention subsequent to his date of invention may first reduce it to practice, and may be held to be entitled to the patent because of the want of diligence of the earlier inventor. Reduction to practice may be accomplished in two ways. First, by carrying out a process on a commercial or practicable scale, by constructing and operating a practicable machine, or by producing an article of manufacture, or composition of matter, or, second, by filing an application for patent, which operates as a constructive reduction to practice. In any event the inventor should take care, in so far as possible, to make his disclosures to persons of intelligence, since otherwise he may jeopardize his rights if he depends upon the evidence of witnesses who do not rightly comprehend the invention or its purposes, and cannot therefore clearly testify as to what the disclosure really was. Memoranda, sketches and letters if once established speak for themselves, it is true, but corroborating witnesses if not intelligent may make difficult even the establishment of such written evidence.



Don't Try to Keep the Idea Secret. If a Patent is Not Applied for Within Two Years After Its Evolution the Patent Office Will Honor a Claim of Another Person Made More Quickly.

It Is Always Well to be Sure Your Idea "Works" Before You Give Your Patent Attorney His Certified Check. "Reduction to Practice" is Required by the Patent Office.

FULL DISCLOSURE IS NECESSARY

Another matter sometimes overlooked by the inventor is the necessity of making a full disclosure in his application for patent. If the patent attorney who draws the application has not all of the facts as the inventor knows them, such inventor should not complain if he finds his invention is not fully covered and protected. If possible, the inventor should supply his attorney with the fullest possible written description of his invention, together with working or intelligible drawings. If the inventor must supply his description verbally, let it be very full and complete. Furthermore, the inventor should insist that he be permitted to take home and consider the specification and claim after the same have been prepared by his attorney, and after he receives such specification he should read the same with the utmost care to be sure that nothing has been left out. After the application has once been filed, while the full opportunity is otherwise afforded for amendment, the examiner will not permit *new matter* to be added. The inventor should also study the claims, which are the measure of the patent, and carefully bear in mind that everything which is *not* claimed *is dedicated to the public.* He should also consider that the more carefully prepared the specification and claims of the application, the more valuable will be the patent when issued. If he hurries his patent attorney, or in his anxiety to get a patent at the least possible expense, employs inferior talent, he must not be surprised if his patent

(*Continued on page* 584)

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Pitfalls of the Radio Inventor

(*Continued from page* 582)

when issued is of such narrow scope as to be of little or no value. If, therefore, the inventor finds himself in a position where by reason of lack of means he is unable to employ a solicitor of standing and experience, he should endeavor to seek out and interest some person with capital in his invention. It is better by far to have a half interest in a valuable patent with broad claims, than the whole interest in a patent with claims so narrow that they are limited to the precise device shown and can be easily avoided by others without penalty.

The inventor should also consider the two years statutory bars of the statute, and take care not to use his invention commercially or publicly for two years before applying for a patent. *A publication or use two years prior to an application completely bars an inventor from the right to a patent.* If, therefore, any person, including the inventor, has described such invention in a printed publication or has used the invention for more than the two years prior to his application, the inventor forfeits his rights, unless he can show such public use was entirely his own and was experimental in character. An example of such experimental use is that of an invention for a city pavement, where it might be necessary in order to test the same experimentally to employ more than the two years public use. Courts, however, are prone to look askance at the suggestion of experimental use in reply to the defense of public use, so that it is wise to avoid public experimental use by the inventor if possible.

EMPLOYEE'S INVENTIONS

Where an employee invents, even though the invention is made during hours of employment, and the employer pays for the prosecution of the application, all that the employer will obtain in the absence of any express agreement is a shop-right or at the most an implied license. The right to the patent still remains in the employee. Where there is an express agreement that the employee will assign to his employer all his inventions relating to the employer's business during the period of his employment, the courts will enforce such agreement and compel the inventor to assign. Agreements, however, of this character are strictly construed, and unless the word assign or the equivalent is used, the tendency of the courts is to give the employer only a shop-right in the invention. If the agreement were not restricted to a particular class of inventions, or to the business of the employer, and required the inventor to assign to his employer all his inventions of any nature whatsoever, the court would hold such an agreement to be in restraint of trade and would refuse to enforce it.

The patent law requires all assignments of patents, as against a subsequent purchaser or mortgagee for a valuable consideration without notice, to be recorded at the Patent Office within three months from the date of the assignment or prior to such subsequent purchase or mortgage. Except, however, as against such purchaser or mortgagee, recording is not necessary to the validity of the assignment or chain of title. This clause is not very important as to the inventor, except as he may desire to protect the interests of assignees, or except perhaps as he himself may acquire patent interests. Any person purchasing a patent should cause a search of the title to be made at the Patent Office at Washington in order to make sure that such title is clear, and should in general take the same precautions as if he were taking title to a parcel of real estate.

JOINT INVENTORS

By *joint inventors* is meant those inventors who together create a single invention. They are entitled to a joint patent, but neither of them can obtain a separate patent for the invention. If they desire they may file separate or joint applications, but only one patent will issue. The fact that one person furnishes the capital and another makes the invention does not entitle them to make an application as joint inventors, but in such case they may become joint patentees upon the inventor assigning an undivided interest to his colleague. Independent inventors of distinct and independent improvements on the same machine cannot obtain a joint patent for their separate inventions. In such case a separate application should be filed for each inventor. Since it can rarely be shown that two or more persons have joined in the creation of the invention, very few applications for a joint invention are filed. Great care should be exercised by the inventor where he supposes he is a joint inventor. In many cases it will be found after carefully sifting the facts that there is in reality but one inventor, and if such inventor is so careless as to permit another person to be joined with him as joint inventor, the results may be very serious in case of litigation. After the patent for a joint invention has been issued, if it develops that the invention is not in fact joint, the patent will be declared to be void.

SECRET PROCESSES

In some instances it may be determined particularly where a process is concerned that such process will be held secret. In case the inventor determines upon such course, he should carefully bear in mind that once he has determined to keep his invention secret, while availing himself of the results commercially, he may, if such secret use is long continued, lose his rights to a patent. Yet in some cases it has happened that the inventor after using his secret process for a number of years has become alarmed lest such process through the unfaithfulness of an employee might be divulged to the public, and has made application for and has received a patent for such process.

Where such facts, however, have appeared to the court, it has been held, in the case of a concealment for the purpose of profit over a long period of years, that the patent will be held to be void because of constructive abandonment or forfeiture of the right of an inventor to a patent.

FOREIGN PATENTS

So far as concerns foreign countries, the inventor should bear in mind that once the invention is divulged to the public, either in the form of a patent or other printed publication, such publication will become a bar to the issuance of a patent. This applies particularly to foreign countries, there being an exception relative to U. S. patents in the case of the inventor himself, who is not debarred from receiving a patent for his invention in this country by reason of its having been first patented by him abroad, unless the application for the said patent was filed more than twelve months prior to the filing of the application in this country. The proper course to pursue in the ordinary case is after notice of allowance is received by the inventor in this country, to utilize the six months in which he is to pay his final fee for the filing of such application in foreign countries as he may desire. In this country a patent does not go to issue, that is become published, until the final fee has been paid, and since the inventor has six months for such payment he has ample time before paying such fee to file his applications abroad.

(*Continued on page* 586)

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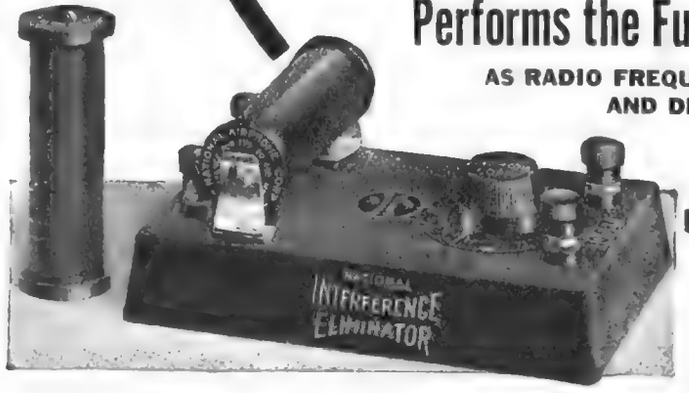

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Pitfalls of the Radio Inventor

(*Continued from page* 584)

Another important matter to be considered is that of constructive abandonment of an invention. This occurs where the inventor by reason of indifference or otherwise permits others to use his invention without objection over a substantial period. Where the invention has been thus abandoned the right of a patent is gone, on the theory that where a gift is once made to the public it can never be taken back. Sometimes where an inventor has ceased experimenting upon a particular device which has proved defective for the purposes for which it was designed, such situation gives rise to the presumption of an abandoned experiment. Once the inventor has exercised his creative faculty and has conceived an intention it is accordingly incumbent upon him to proceed diligently in effecting his invention and applying for a patent, since otherwise, his lack of diligence or his slothfulness may be construed as an abandonment, in which case his right to a patent is entirely gone.

Such are the main pitfalls to be encountered by the ordinary inventor in this country, most of which may be avoided through the use of ordinary care on the part of the inventor. At all times he should bear in mind the maximum of the equity courts, in which most patent cases for infringement are tried, which is, that equity aids the vigilant, not those who slumber upon their rights.

Radio Broadcast

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(Revised to date)

Call	*Name*	*City and State*	*Wave-Lengths*
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KDPM	Westinghouse Electric & Manufacturing Co.	Cleveland, Ohio	270
KDPT	Southern Electric Co.,	San Diego, Cal.	
KDYL	Telegram Publishing Co.,	Salt Lake City, Utah	360
KDYM	Savoy Theatre	San Diego, Cal.	252
KDYQ	Oregon Institute of Technology,	Portland, Ore.	
KDYS	The Tribune	Great Falls, Mont.	360
KDYW	Smith Hughes & Co.	Phoenix, Ariz.	
KDYX	Star Bulletin	Honolulu, Hawaii	
KDZB	Frank E. Siefert	Bakersfield, Cal.	
KDZE	The Rhodes Co.	Seattle, Wash.	
KDZF	Auto Club of Southern California,	Los Angeles, Cal.	278
KDZI	Electric Supply Co.,	Wenatchee, Wash.	
KDZK	Nevada Machinery & Electric Co.,	Reno, Nev.	
KDZQ	Nichols Academy of Music,	Denver, Colo.	
KDZR	Bellingham Publishing Co.,	Bellingham, Wash.	261
KDZT	Seattle Radio Association,	Seattle, Wash.	
KFAD	McArthur Bros. Mercantile Co.,	Phoenix, Ariz.	
KFAE	State College of Washington,	Pullman, Wash.	
KFAF	Western Radio Corp.,	Denver, Colo.	
KFAJ	University of Colorado,	Boulder, Colo.	
KFAN	The Electric Shop	Moscow, Idaho	
KFAP	Standard Publishing Co.,	Butte, Mont.	
KFAQ	City of San Jose	San Jose, Cal.	
KFAR	Studio Lighting Service Co.,	Hollywood, Cal.	280
KFAT	S. T. Donohue	Eugene, Ore.	275
KFAU	Independent School District of Boise City, Boise High School,	Boise, Idaho	270
KFAV	Abbot Kinney Co.	Venice, Cal.	258
KFAW	The Radio Den (W. B. Ashford and T. White)	Santa Ana, Cal.	
KFAY	Virgin's Radio Service.	Medford, Ore.	360
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(*Continued on page* 588)

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31x4	7.00	1.60	35x4½	9.25	2.60
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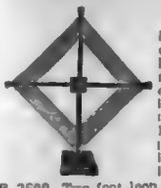
NOTE BIG PRICE REDUCTIONS THIS MONTH **Money refunded if goods do not satisfy**

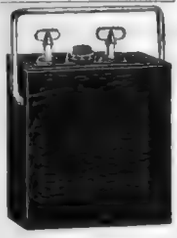
LOOP AERIAL



The loop aerial you have been waiting for. Made entirely of well seasoned hard wood. Complete with all parts and base; No. 22 enameled wire used. Total height of loop 36", 2 feet on the side; loop is 10 convolutions. Can be put together by anyone in less than 5 minutes. Satisfaction guaranteed.

R-2600. Two foot loop aerial, complete....$1.15

STORAGE BATTERIES



New! New! New! Two volt, 40 ampere hour storage battery for use with WD11, 12, and U.V. 199 tubes. Don't keep on buying dry cells continuously. This storage battery will pay for itself in two months. Only best materials used. Guaranteed for 2 years. You can connect up to 6 dry cell tubes on a single one of these batteries. Can be recharged for a few cents. Hard rubber container encased in impregnated wood case. Due to low price and large weight of batteries, shipped express collect.

R-2400, Two volt, 40 ampere hour storage battery, size 2¼x8x9" $4.25
R-640, Six volt, 40 ampere hour storage battery, size 4¾x7¼x9" 8.75
R-660, Six volt, 60 ampere hour storage battery, size 6x7x9¼" 11.00

WOOD CABINETS

Highest grade mahogany cabinets made. Best hand rubbed finish. Top is hinged. Front of cabinet rabbetted to fit panel. Price delivered to your door; no panel included in these prices. Entire cabinet made of ⅞" well seasoned stock.

R-714, Wood cabinets, panel size 7"x14"...$3.35
R-718, Wood cabinets, panel size 7"x18"... 3.60
R-724, Wood cabinets, panel size 7"x24"... 4.40
R-710, Wood cabinets, panel size 7"x10"... 2.60
R-712, Wood cabinets, panel size 7"x12"... 3.00
R-721, Wood cabinets, panel size 7"x21"... 3.90

CARDBOARD TUBING

Only seamless tubing made in United States. Perfectly seasoned. Heavy wall. (I.D.—Inside Diameter. O.D.—Outside Diameter. L.—Length).

R-6600, 3" I.D., 3⅛" O.D. x 7" L. .....$.30
R-6601, 3½" I.D., 3⅝" O.D. x 7" L..... .35
R-6602, 3⅝" I.D., 3¾" O.D. x 5" L..... .25
R-6603, 3¾" I.D., 4" O.D. x 5" L..... .27
R-6604, 4" I.D., 4¼" O.D. x 5" L..... .35
R-6605 4¾" I.D. 5" O.D. x 2¾" L..... .15

"RASCO" BEZELS

The finest Dezel on the market. Best brass mesh used. The Bezel comes entirely nickle plated. Will improve looks of your panel 100 per cent. Outside diameter 1". Can be used on ⅛" or 3-16" panel.

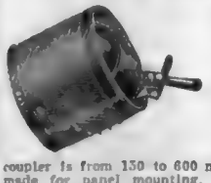
R-1700, Rasco bezel.....$.15
R-1701, Bezel 1⅛" diam... .20

FORMICA PANELS Clearance Sale.

This sheeting is positively the best grade on the market. High Finish on both sides. Too well known to require much explanation. Due to the fact that we are discontinuing these particular sizes, this material is now offered practically at cost. Prices are about 40 per cent lower than our catalogue list. Note also that we ship these panels prepaid. This alone amounts to a considerable saving.

R-350, 6"x12"x3-16" thick, each.....$1.50
R-351, 6"x18"x3-16" thick, each..... 1.60
R-352, 9"x12"x3-16" thick, each..... 1.75
R-353, 12"x18"x3-16" thick, each..... 4.00
R-354, 6½"x18½"x3-16" thick, each..... 1.90
R-355, 6"x7½"x3-16" thick, each..... .85
R-356, 6"x11"x2-16" thick, each..... 1.60
R-357, 6"x4"x3-16" thick, each..... .65

RASCO 180° VARIOCOUPLER



This Coupler while extremely low in price will do anything and everything that the more expensive ones accomplish. Silk Wire wound on bakelite tubes. There are six taps. Wave length of coupler is from 150 to 600 meters. Coupler is made for panel mounting, ¼" shaft. Your money refunded if it does not do all that we claim for it.

R-3100 Variocoupler, prepaid.....$1.50

MELOTONE LOUD SPEAKER

The best popular loud speaker on the market. Has tuned feature the same as all "Rico" phones. Fibre horn, heavy metal base, five foot cord. Nickle gooseneck. Greatest tuned loud talker. Compares favorably with most expensive speakers. Size overall 14½"; horn length 11⅛"; bell 6⅝"; total height 9".

R-255, Melotone Speaker.....$4.90

RICO TUNED RECEIVERS

No better phones made. Supersensitive. Awarded Radio News Laboratories Certificate of Merit. The only tuned phone on the market. Can be tuned for any intensity and sensitivity. Magnetic pole of phone is in mathematical center of diaphragm "Turn the cap to tune."

R-2020, 2000 ohms, double head set $4.45
R-3030, 3000 ohms, double head set $5.50

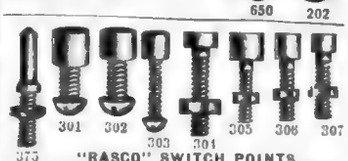
"RASCO" VERNIER

Cleverest vernier made. Can be used with any dial. Soft rubber ring engages dial. Does away with vernier condenser. We guarantee results. All metal parts moulded in best black composition. Nothing to come apart. Biggest hit of the season.

R-1450, Vernier .....$.30

"RASCO" POSTS

R-650, Post made entirely of best black composition—8/32" screw—each .....$.08
R-202, Post has nickel-plated bottom part, each..... .08
Dozen, each style ..... .90



"RASCO" SWITCH POINTS

Nickel-plated and polished. The following have been found the most popular.

R-301, ¼"x⅜", 6/32" thread, doz.....$.18
R-302, 3/16" high, ⅛" dia., 6/32" thread doz. .18
R-303, 3/16"x3/16", 4-36" thread, doz.... .18
R-304, ⅛" dia., ⅛" thick; shank 6/32" doz. .18
R-305, ¼" dia., 3/16" thick; shank 4/38", doz. .18
R-306, 3/16" dia., 3/16" thick, shank 4/36 doz. .18
R-307, 3/16" dia., ⅛" thick; shank 4/36, doz. .18
R-375, Switch Stop, ⅞" long, 4/36 thread, complete with nut, each ..... .18

"RASCO" SOCKETTES

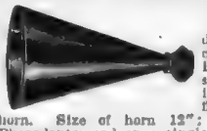
Substitute for Vacuum Tube Socket. Four of these take one Vacuum Tube. Grasp tube firmly. Best contact possible. Take less room. Are better.

R-1550, Sockettes, nickeled, set of 4 .....$.25
R-1551 Sockettes, nickeled, set of 4 (to take WD-11 Tube) ..... .25
Note: Set of 4 sufficient to hold 1 Tube

COPPER FOIL

Thinnest copper foil made, .001" thick. Comes 4" wide
R-5025, Copper Foil, per ft. $.10
10-ft. length ..... .80

PHONEHORN



Fills a new and distinct want. Base consists of R-1310 Phonodapter described on this page into which fits a fine enameled fibre horn. Size of horn 12"; bell 6½". Slip Phonodapter end on a single telephone receiver and you have the lowest priced loud talker ever made. Mounted in your set or hung in corner of room it will bring sound all over the room. A most useful article. Welcome by all radio fans. R-1321 Phonehorn, prepaid $1.45

AUDIO FREQUENCY TRANSFORMERS

No better Transformer on the market. Highest class materials. Impregnated coils. Silicon steel stampings used. Save 50 per cent by assembling it yourself.

R-1100, A.F. Transformer, ratio 4½ to 1 .....$2.00
R-1150, A.F. Transformer, ratio 6½ to 1 .....$2.00

RADIO FREQUENCY TRANSFORMERS

The best Radio Frequency Transformer developed so far. Designed for us by Mr. R. E. Lacault, Associate Editor of RADIO NEWS. Air core. Guaranteed to do the work. This Transformer brings in the long distances.

R-2800 Radio Frequency Transformer, size 1⅞"x3½" $1.50

RHEOSTATS AND POTENTIOMETERS

Highest grade Rheostat made. High heat dielectric composition base. Wound with best non-corrosive resistance wire. Comes with tapered, knurled knob. Diameter, 2⅛". Complete with pointer.

R-4310—6 ohm, each $.45
R-4311—30 ohms, for 301a and 201a tubes, each .....$.65
R-4312—Potentiometer, 200 Ohms each..$.85

JUST OUT Cat. No. 10

SPIDER WEB FORMS

At last! Fine forms to wind your spider webs. Made from hard, well seasoned fibre, 1-16" thick, center and side holes for wiring. 3200 has 13 slots, 3201, 11 slots, both 5" diameter. 3201 has projection for mounting.

B-3200—Spider web form, each .....$.25
R-3201—Spider web form, each .....$.25

BRASS RODS

Sold in 6" lengths only

R-8032, Brass Rod, 8/32" thread, per length .....$.
R-6032, Brass Rod, 6/32" thread, per length ..... .06
R-1425, Brass Rod, plain ¼" round, per length ..... .10
R-3616 Brass Rod, plain 3/16" round, per length ..... .06

"RASCO" NAME PLATES

The circular plate is our new Binding Post Name Plate. Diameter, ⅞". These denominations: PHONES, GROUND, —, OUTPUT, "A" BATTERY —, "B" BATTERY —, LOUD SPEAKER, GRID, LOAD, "C" BATTERY —, AERIAL, +, INPUT, "A" BATTERY + "B" BATT +, LOOP, TICKLER, PLATE, "C" BATT +, FILAMENT

R-6006 to 6019, Binding Post Name Plates, each denomination .....$.03
Dozen ..... .30

REINARTZ SPIDERWEB COIL

Here is a very fine inductance for Reinartz circuit, 200-600 meters. 19 taps. Size 4¾" diameter; 1⅞" center opening. Can be used in nearly all new circuits. Construction: duo-spider-web throughout. Coil is firm and will not fall apart as is case with many inferior makes. A few of these coils will work wonders in your set.

P-2650 Spider-web Reinartz coil $1.15

PHONODAPTER

The Phonodapter will fit any phone. Metal tube fits any standard phonograph. Make your phonograph a loud talker. Fits Columbia, Victor and Sonora phonographs. Is made entirely of pure soft rubber with brass tube inserted.

R-1310 Phonodapter ..... $. 56

DOUBLE PHONODAPTER

The Double Phonodapter fits all phonographs and will take any standard double head set, thereby making your phonograph a loud talker. Made of cast metal, nickel plated and highly polished. Has three generous soft rubber bushings.

R-1320 Double Phonodapter ..... $. 65

PLUGS

RASCO Telephone Plug. This is the plug that is sold from 75c. to $1.00 everywhere. Has hard rubber composition shell and patented cord tip holder. Must be seen to be appreciated. Finest workmanship throughout.

R-1030—Rasco Telephone Plug, each.....$.35

LITZ WIRE

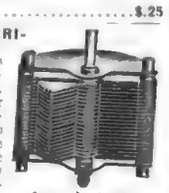
R-323, equals No. 25 B&S, per foot .....$.02
R-890, equals No. 28 B&S, per foot ..... .01
R-891, equals No. 21 B&S, per foot ..... .03
R-892, equals No. 20 B&S per foot ..... .04
Discounts of 10 percent in 100-ft. lots.

UNIVERSAL BEARING

THE bearing to hold variometer and variocoupler rotors. Total length of bearing 2⅛". Outside shaft, 1⅛". Length of thread 1". Length of threaded sleeve, ⅝".

R-1375. Bearing .....$.25

PANEL MOUNTING VARIABLE CONDENSERS



This condenser presents the latest word in precision mechanics. Plates, washers, and all other parts are accurately machined. Positively no better condenser on the market. Shafts ¼". Save from 40% to 60% by assembling condenser yourself. A child can do it in a few minutes spare time. Capacities guaranteed.

R-1111 11 plate condenser, .00025 mfd....$1.10
R-2121 21 plate condenser, .0005 mfd..... 1.22
R-4343 43 plate condenser, .001 mfd..... 1.50

The "Rasco" Catalog

CONTAINS 75 VACUUM TUBE HOOK-UPS, 350 ILLUSTRATIONS 550 ARTICLES, 84 PAGES **No. 10**

All Armstrong Circuits: These important circuits are explained clearly, all values having been given leaving out nothing that could puzzle you.

Just to name a few of the Vacuum Tube circuits: The V.T as a detector and one-step amplifier; Armstrong circuits; one-step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; 4-stage radio frequency amplifiers; radio and audio frequency amplifier; inductively coupled amplifier; Armstrong supersautodyne, etc. Catalog mailed out upon receipt of 15 Cents in Stamps or Coin.

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....I am interested in your "Earn While You Learn" Plan.

Name ..... Age .....

Address .....

City ..... State .....

Education .....

Radio Broadcast

(*Continued from page 586*)

Call	Name	City and State	Wave-Lengths
KFBC	W. K. Azbill	San Diego, Cal.	
KFBE	Reuben H. Horn	San Luis Obispo, Cal.	
KFBG	First Presbyterian Church	Tacoma, Wash.	
KFBK	Kimball-Upson Co.	Sacramento, Cal.	360
KFBL	Leese Bros.	Everett, Wash.	224
KFBS	Trinidad Gas & Electric Supply Co. and Chronicle News	Trinidad, Colo.	
KFBU	The Cathedral	Laramie, Wyo.	
KFCD	Salem Electric Co.	Salem, Ore.	
KFCF	Frank A. Moore.	Walla Walla, Wash.	
KFCH	Electric Service Station (Inc.),	Billings, Mont.	
KFCK	Colorado Springs Radio Co.,	Colorado Springs, Colo.	
KFCL	Los Angeles Union Stock Yards,	San Antonio, Cal.	360
KFCM	Richmond Radio Shop (F. T. Doeing)	Richmond, Cal.	
KFCP	Ralph W. Flygare	Ogden, Utah	
KFCV	Fred Mahaffey, Jr.	Houston, Texas	
KFCY	Western Union College.	Le Mars, Iowa	
KFCZ	Omaha Central High School,	Omaha, Neb.	
KFDA	Adler's Music Store	Baker, Ore.	
KFDB	Mercantile Trust Co. of Calif.,	San Francisco, Calif.	
KFDC	Radio Supply Co. (E. B. Craney),	Spokane, Wash.	283
KFDD	St. Michaels Cathedral.	Boise, Idaho	252
KFDF	Casper Community Radio Corporation	Casper, Wyo.	360
KFDH	University of Arizona.	Tucson, Ariz.	
KFDJ	Oregon Agricultural College,	Corvallis, Ore.	
KFDL	Knight-Campbell Music Co.,	Denver, Colo.	
KFDO	H. Everett Cutting.	Bozeman, Mont.	248
KFDP	Hawkeye Radio & Supply Co.,	Des Moines, Iowa	278
KFDR	Bullock's Hardware & Sporting Goods	York, Neb.	
KFDU	Nebraska Radio Electric Co.	Lincoln, Neb.	240
KFDV	Gilbrech & Stinson,	Fayetteville, Ark.	
KFDX	First Baptist Church,	Shreveport, La.	360
KFDY	South Dakota State College of Agriculture and Mechanic Arts,	Brookings, S. D.	360
KFDZ	Harry O. Iverson.	Minneapolis, Minn.	360
KFEC	Meier & Frank Co.	Portland, Ore.	360
KFEJ	Guy Greason	Tacoma, Wash.	
KFEL	Winner Radio Corp.	Denver, Colo.	
KFEP	Radio Equipment Co.	Denver, Colo.	240
KFEQ	J. L. Scroggin	Oak, Neb.	
KFER	Auto Electric Service Co.,	Fort Dodge, Iowa	231
KFEV	Radio Electric Shop.	Douglas, Wyo.	263
KFEX	Augsbrug Seminary,	Minneapolis, Minn.	261
KFEY	Bunker Hill & Sullivan Mining and Concentrating Co.	Kellogg, Idaho	360
KFEZ	American Society of Mechanical Engineers	St. Louis, Mo.	360
KFFA	Dr. R. O. Shelton	San Diego, Cal.	242
KFFB	Jenkins Furniture Co.	Boise, Idaho	240
KFFE	Eastern Oregon Radio Co.,	Pendleton, Ore.	
KFFO	Dr. E. H. Smith	Hillsboro, Ore.	229
KFFP	First Baptist Church.	Moberly, Mo.	275
KFFQ	Marksheffel Motor Co.,	Colorado Springs, Colo.	360
KFFR	Nevada State Journal (Jim Kirk),	Sparks, Nev.	360
KFFV	Graceland College	Lamoni, Iowa	360
KFFX	McGraw Co.	Omaha, Neb.	278
KFFY	Pincus & Murphey.	Alexandria, La.	275
KFFZ	Al. G. Barnes Amusement Co. (Portable)	Dallas, Texas	226
KFGC	Louisiana State University,	Baton Rouge, La.	254
KFGD	Chickasha Radio & Electric Co.,	Chickasha, Okla.	248
KFGH	Leland Stanford University,	Stanford University, Cal.	
KFGJ	Missouri National Guard, 138th Infantry	St. Louis, Mo.	266
KFGL	Arlington Garage	Arlington, Ore.	234
KFGP	Cheney Radio Co.	Cheney, Kan.	229
KFGQ	Crary Hardware Co.	Boone, Iowa	226
KFGV	Heidbreder Radio Supply Co.,	Utica, Neb.	224
KFGX	First Presbyterian Church,	Orange, Tex.	250
KFGY	Gjelhaug's Radio Shop,	Baudette, Minn.	224
KFGZ	Emmanuel Missionary College,	Berrion Springs, Mich.	268
KFHA	Colorado State Normal School,	Gunnison, Colo.	360
KFHB	Rialto Theater	Hood River, Ore.	280
KFHD	Utz Electric Shop Co.	St. Joseph, Mo.	226
KFHF	Central Christian Church,	Shreveport, La.	266

(*Continued on page 590*)

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30x3	$1.90	$ .90	32x4½	$3.75	$1.65
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32x3½	2.50	.90	34x4½	4.00	1.65
31x4	2.75	.90	35x4½	4.25	1.65
32x4	3.00	1.40	36x4½	4.25	1.65
33x4	3.25	1.40	35x5	4.25	1.95
34x4	3.50	1.40	37x5	4.25	1.95

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Every packet contains complete instructions for the construction of these circuits including the tools required, parts needed, directions and pattern for drilling, mounting and wiring and most important of all, full instruction on how to tune the circuit. Sets constructed from these plans have been thoroughly tested and pronounced perfect.

How to Make a Cockaday Receiver

The Cockaday four-circuit tuner is one of the latest advancements in radio. Its main advantage lies in the fact that the set can be adjusted to the highest point of regeneration, and tuning accomplished over a wide band of wave-lengths without the necessity for readjusting the regeneration control. The set described in our folder was designed and built at our own shop. All dimensions, size of wire, number of turns, etc., are given, leaving nothing to the imagination.

50c.

How to Make a Reflex Receiver

The plans for the reflex receiver were gotten out only after considerable research work by our engineers. Most people have trouble with reflex receivers. It takes an expert to build one that will work satisfactorily. The trouble lies in the values of condensers, etc., in the circuits. If they are incorrect, the set is a dismal failure. The constructional details of a reflex receiver, contained in this folder, are the results of their successful efforts.

50c.

How to Make a Reinartz Receiver

The original Reinartz Receiver is the most popular type of set in existence today. It gained its popularity through its simplicity of operation and capability of long-distance reception. Full directions for building this receiver are given in this folder. The construction of the coil—the most difficult part—is made easy with the concise instructions we furnish. The connections of the set are shown plainly, so that the novice will have no trouble in following them.

50c.

Twenty Radio Phone Diagrams and Hook-Ups With Supplements of Latest Hook-Ups

These diagrams show how to get the best possible efficiency from the instruments you make or purchase. They cover hook-ups from the simplest to the most complicated, in a way that any amateur can understand and follow without difficulty. Printed on heavy paper, 8½x11½ inches, and together with KEY CHART OF SYMBOLS and pamphlet "HOW TO READ DIAGRAMS", are contained in a heavy two-color envelope.

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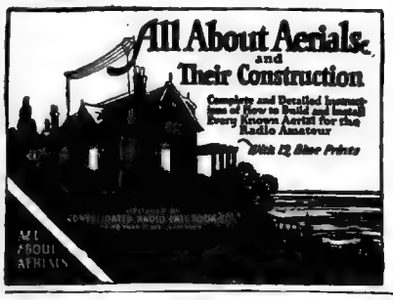

All About Aerials and Their Construction

These blue prints were made after practical erection of each aerial, and point out how simple it is to erect not only the proper aerial for your particular need, but how to erect this aerial in the most practical manner and at the least expense.

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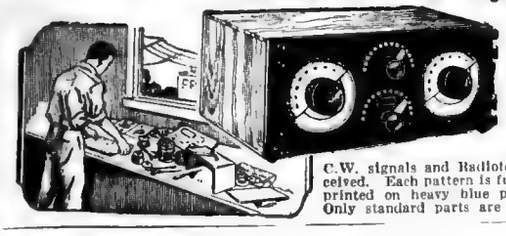

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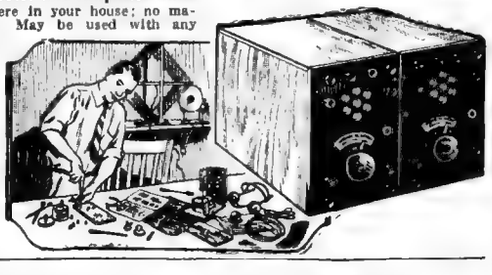

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....Bookkeeper	....Surveyor (& Mapping)
....Draftsman and Designer	....Telephone Engineer
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....Vocational Guidance	....Wireless Radio
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Radio Broadcast

(*Continued from page* 588)

Call	Name	City and State	Wave-Lengths
KFHH	Ambrose A. McCue,	Neah Bay, Wash.	283
KFHI	Charles V. Dixon	Wichita, Kan.	224
KFHJ	Fallon & Co.	Santa Barbara, Cal.	
KFHL	Penn College	Oskaloosa, Iowa	227
KFHP	Radio-Bug Products Co.,	Kearney, Neb.	246
KFHQ	Curtis Bros. Hardware Store (Alfred E. Fowler)	Los Gatos, Cal.	242
KFHR	Star Electric & Radio Co.,	Seattle, Wash.	270
KFHS	Clifford J. Dow	Lihue, Hawaii	275
KFHU	M. G. Sateren	Mayville, N. D.	261
KFHX	Robert W. Nelson,	Hutchinson, Kan.	229
KFHY	R. S. McEwan	Trinidad, Colo.	242
KFI	Earle C. Anthony (Inc.),	Los Angeles, Cal.	469
KFIB	Franklin W. Jenkins	St. Louis, Mo.	244
KFIC	Phillip Laskowitz	Denver, Colo.	224
KFID	Ross Arbuckle's Garage	Iola, Kan.	246
KFIF	Benson Polytechnic Institute,	Portland, Ore.	360
KFIJ	Sidney I. Thoreau	Platte, S. D.	236
KFIK	Gladbrook Electrical Co.,	Gladbrook, Iowa	234
KFIL	Windisch Electric Farm Equipment Co.	Louisburg, Kan.	234
KFIO	North Central High School,	Spokane, Wash.	252
KFIQ	Yakima Valley Radio Broadcasting Association	Yakima, Wash.	224
KFIU	Alaska Electric Light & Power Co.,	Juneau, Alaska	226
KFIV	V. H. Broyles	Pittsburg, Kan.	240
KFIX	Reorganized Church of Jesus Christ of Latter Day Saints,	Independence, Mo.	240
KFJA	Central Power Co.	Grand Island, Neb.	244
KFJB	Marshall Electric Co.,	Marshalltown, Iowa	248
KFJD	Weld County Printing & Publishing Co.	Greeley, Colo.	236
KFKA	Colorado State Teachers' College,	Greeley, Colo.	248
KFKH	Denver Park & Amusement Co.,	Lakeside, Colo.	226
KFLE	National Education Service,	Denver, Colo.	268
KFZ	Doerr-Mitchell Electric Co.,	Spokane, Wash.	283
KGB	William A. Mullins Electric Co.,	Tacoma, Wash.	
KGG	Hallock & Watson Radio Service,	Portland, Ore.	
KGM	Northwestern Radio Mfg. Co.,	Portland, Ore.	
KGO	Altadena Radio Laboratory,	Altadena, Cal.	
KGU	Marion A. Mulrony,	Honolulu, Hawaii	
KGW	Portland Morning Oregonian,	Portland, Ore.	492
KGY	St. Martins College	Lacey, Wash.	258
KHJ	Times-Mirror Co.	Los Angeles, Cal.	395
KHQ	Louis Wasmer	Seattle, Wash.	
KJQ	C. O. Gould	Stockton, Cal.	
KJR	Northwest Radio Service Co.,	Seattle, Wash.	270
KJS	Bible Institute of Los Angeles,	Los Angeles, Cal.	
KLN	Monterey Electric Shop,	Monterey, Cal.	261
KLS	Warner Bros.	Oakland, Cal.	
KLX	Tribune Pub. Co. (Oakland Tribune)	Oakland, Cal.	
KLZ	Reynolds Radio Co.	Denver, Colo.	360
KMC	W. W. Lindsay, Jr.	Reedley, Cal.	
KMJ	San Joaquin Light & Power Corp.,	Fresno, Cal.	
KMO	Love Electric Co.	Tacoma. Wash.	
KNJ	Roswell Public Service Co.,	Roswell. N. M.	
KNT	Grays Harbor Radio Co.,	Aberdeen, Wash.	263
KNV	Radio Supply Co.	Los Angeles, Cal.	
KNX	Electric Lighting Supply Co.,	Los Angeles, Cal.	
KOB	New Mexico College of Agriculture and Mechanic Arts.	State College, N. M.	
KOP	Detroit Police Department,	Detroit. Mich.	286
KPO	Hale Bros.	San Francisco, Cal.	423
KQI	University of California,	Berkeley. Cal.	
KQP	Apple City Radio Club,	Hood River, Ore.	360
KQV	Doubleday-Hill Electric Co.,	Pittsburgh, Pa.	
KQW	Charles D. Herrold	San Jose, Cal.	
KRE	Berkeley Daily Gazette.	Berkeley, Cal.	278
KSD	Post Dispatch	St. Louis, Mo.	546
KSS	Prest & Dean Radio Co. and Radio Research Society of Long Beach, Cal.	Long Beach, Cal.	

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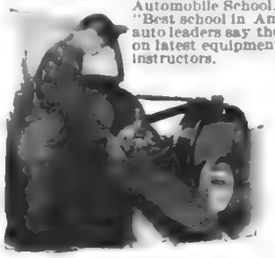

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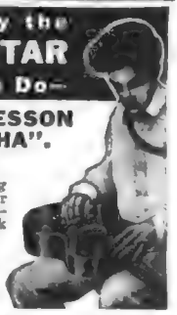

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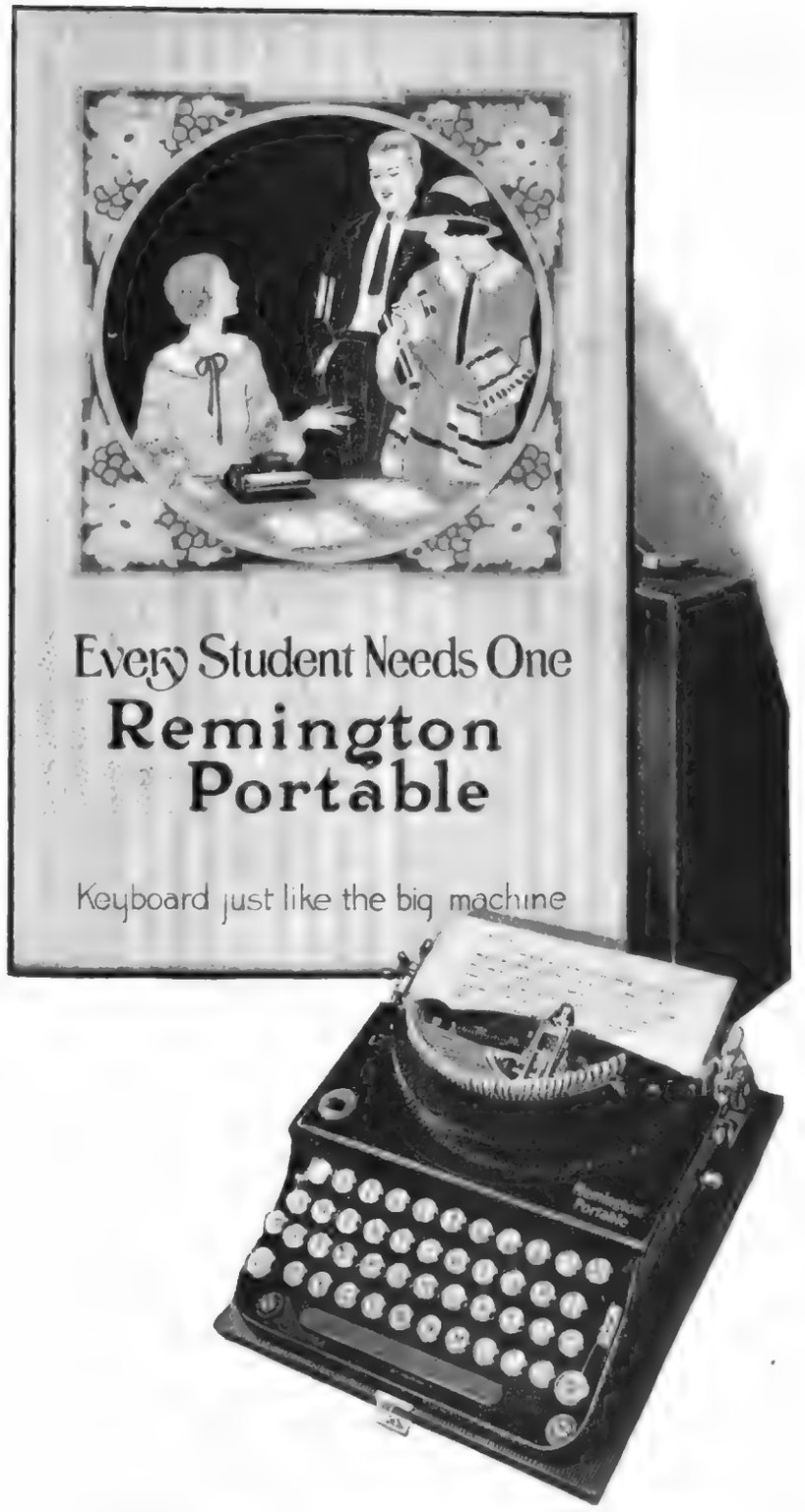
KUO	Examiner Printing Co. (San Francisco Examiner),	San Francisco, Cal.	360
KUS	City Dye Works & Laundry Co.,	Los Angeles, Cal.	
KUY	Coast Radio Co.	El Monte, Cal.	
KWG	Portable Wireless Telephone Co.,	Stockton, Cal.	
KWH	Los Angeles Examiner,	Los Angeles, Cal.	360
KXD	Modesto Herald Publishing Co.,	Modesto, Cal.	
KYQ	Electric Shop	Honolulu, Hawaii	
KYW	Westinghouse Electric & Manufacturing Co.	Chicago, Ill.	345
KZM	Preston D. Allen	Oakland, Cal.	
KZN	The Deseret News,	Salt Lake City, Utah	360
KZV	Wenatchee Battery & Motor Co.,	Wenatchee, Wash.	
WAAB	Valdemar Jensen	New Orleans, La.	268
WAAC	Tulane University	New Orleans, La.	
WAAD	Ohio Mechanics Institute,	Cincinnati, Ohio	
WAAF	Chicago Daily Drovers Journal,	Chicago, Ill.	
WAAH	Commonwealth Electric Co.,	St. Paul, Minn.	
WAAK	Gimbel Bros.	Milwaukee, Wis.	280
WAAM	I. R. Nelson Co.	Newark, N. J.	263
WAAN	University of Missouri,	Columbia, Mo.	254
WAAP	United Electric Co.	Wichita, Kan.	
WAAW	Omaha Grain Exchange,	Omaha, Neb.	360
WAAZ	Hollister-Miller Motor Co.,	Emporia, Kan.	
WABA	Lake Forest College	Lake Forest, Ill.	266
WABB	Dr. John B. Lawrence,	Harrisburg, Pa.	266
WABC	Fulwider-Grimes Battery Co.,	Anderson, Ind.	229
WABD	Parker High School	Dayton, Ohio	283
WABE	Young Men's Christian Association,	Washington, D. C.	283
WABF	Mount Vernon Register-News Co.,	Mount Vernon, Ill.	234
WABG	Arnold Edwards Piano Co.,	Jacksonville, Fla.	248
WABH	Lake Shore Tire Co.	Sandusky, Ohio	240
WABI	Bangor Railway & Electric Co.,	Bangor, Me.	240
WABJ	The Radio Laboratories,	South Bend, Ind.	240
WABK	First Baptist Church,	Worcester, Mass.	252
WABL	Connecticut Agricultural College,	Storrs, Conn.	283
WABM	F. E. Doherty Automotive & Radio Supply Co.	Saginaw, Mich.	254
WABN	Waldo C. Grover	La Crosse, Wis.	234
WABO	Lake Avenue Baptist Church,	Rochester, N. Y.	252
WBAA	Purdue University,	West Lafayette, Ind.	
WBAD	Sterling Electric Co.,	Minneapolis, Minn.	
WBAF	Fred M. Middleton,	Moorestown, N. J.	
WBAH	The Dayton Co.,	Minneapolis, Minn.	
WBAN	Wireless Phone Corp.,	Paterson, N. J.	244
WBAO	James Millikin University,	Decatur, Ill.	
WBAP	Wortham-Carter Publishing Co. (Star Telegram),	Fort Worth, Tex.	476
WBAU	Republican Publishing Co.,	Hamilton, Ohio	258
WBAV	Erner & Hopkins Co.,	Columbus, Ohio	390
WBAW	Marietta College	Marietta Ohio	246
WBAX	John H. Stenger, Jr.,	Wilkes Barre, Pa.	
WBAY	American Telephone & Telegraph Co.	New York, N. Y.	492
WBBA	Newark Radio Laboratories,	Newark, Ohio	240
WBBC	Sterling Radio Equipment Co.,	Sterling, Ill.	229
WBBD	Barbey Battery Service	Reading, Pa.	234
WBL	T & H Radio Co.	Anthony, Kan.	261
WBS	D. W. May (Inc.)	Newark, N. J.	
WBT	Southern Radio Corporation,	Charlotte, N. C.	360
WBU	City of Chicago	Chicago, Ill.	286
WBZ	Westinghouse Electric & Manufacturing Co.	Springfield, Mass.	337
WCAD	St. Lawrence University,	Canton, N. Y.	280
WCAE	Kaufmann & Baer Co.,	Pittsburgh, Pa.	462
WCAG	Clyde R. Randall,	New Orleans, La.	268
WCAH	Entrekin Electric Co.	Columbus, Ohio	286
WCAJ	Nebraska Wesleyan University,	University Place, Neb.	
WCAK	Alfred P. Daniel	Houston, Tex.	
WCAL	St. Olaf College	Northfield, Minn.	
WCAM	Villanova College	Villanova, Pa.	
WCAO	Sanders & Stayman Co.,	Baltimore, Md.	
WCAP	Chesapeake & Potomac Telephone Co.	Washington, D. C.	469
WCAR	Alamo Radio Electric Co.,	San Antonio, Tex.	



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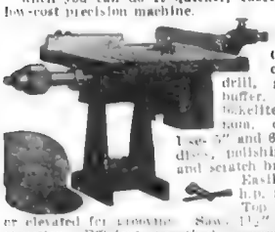

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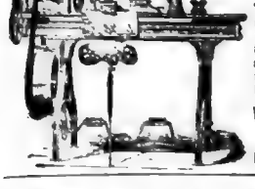

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WCAT	South Dakota State School of Mines,	Rapid City, S. D.	240
WCAU	Durham & Co.	Philadelphia, Pa.	286
WCAV	J. C. Dice Electric Co.,	Little Rock, Ark.	
WCAX	University of Vermont,	Burlington, Vt.	
WCAY	Kesselman O'Driscoll Co.,	Milwaukee, Wis.	261
WCAZ	Robert E. Compton & Carthage College	Carthage, Ill.	
WCBA	Charles W. Heimbach, 1015 Allen St.,	Allentown, Pa.	280
WCBB	K & K Radio Supply Co. (Charles W. Katzenberger),	Greenville, Ohio	240
WCBD	Wilbur G. Voliva	Zion, Ill.	345
WCE	Findley Electric Co.,	Minneapolis, Minn.	
WCK	Stix-Baer & Fuller Dry Goods Co.,	St Louis, Mo.	
WCM	University of Texas.	Austin, Tex.	
WCN	Clark University	Worcester, Mass.	360
WCX	Detroit Free Press.	Detroit, Mich.	517
WDAD	Central Kansas Radio Supply,	Lindsborg, Kan.	
WDAE	Tampa Daily Times.	Tampa, Fla.	360
WDAF	Kansas City Star.	Kansas City, Mo.	411
WDAG	J. Laurance Martin.	Amarillo, Tex.	
WDAH	Trinity Methodist Church (South),	El Paso, Tex.	
WDAI	Hughes Radio Corporation,	Syracuse, N. Y.	246
WDAJ	Atlanta & West Point R. R. Co.,	College Park, Ga.	360
WDAK	The Courant	Hartford, Conn.	261
WDAL	Florida Times-Union,	Jacksonville, Fla.	360
WDAO	Automotive Electric Co.	Dallas, Tex.	
WDAP	Board of Trade	Chicago, Ill.	360
WDAR	Lit Bros.	Philadelphia, Pa.	395
WDAS	Samuel A. Waite.	Worcester, Mass.	
WDAU	Slocum & Kilburn,	New Bedford, Mass.	
WDAX	First National Bank,	Centerville, Iowa	
WDAY	Fargo Radio Service Co. (K. M. Hance)	Fargo, N. D.	244
WDBC	Kirk, Johnson & Co.	Lancaster, Pa.	258
WDBF	Robert G. Phillips.	Youngstown, Ohio	261
WDM	Church of the Covenant,	Washington, D. C.	
WDT	Ship Owners Radio Service,	Stapleton, N. Y.	405
WDZ	James L. Bush	Tuscola, Ill.	278
WEAA	Fallain & Lathrop.	Flint, Mich.	280
WEAB	Standard Radio Equipment Co.,	Fort Dodge, Iowa	360
WEAD	Henry Radio and Electrical Supply Co.	Atwood, Kan.	268
WEAF	Western Electric Co.,	New York, N. Y.	492
WEAG	Nichols-Hineline-Bassett Laboratory,	Edgewood, R. I.	231
WEAH	Wichita Board of Trade and Lander Radio Co.	Wichita, Kan.	
WEAI	Cornell University	Ithaca, N. Y.	286
WEAJ	University of South Dakota,	Vermilion, S. D.	
WEAK	Julius B. Abercrombie,	St. Joseph, Mo.	
WEAM	Borough of North Plainfield,	North Plainfield, N. J.	250
WEAN	Shepard Co.	Providence, R. I.	273
WEAO	Ohio State University,	Columbus, Ohio	360
WEAP	Mobile Radio Co.	Mobile, Ala.	
WEAR	Baltimore American & News Publishing Co.	Baltimore, Md.	
WEAS	Hecht Co.	Washington, D. C.	
WEAU	Davidson Bros. Co.	Sioux City, Iowa	360
WEAY	Iris Theatre (Will Horowitz, Jr.),	Houston, Tex.	
WEB	Benwood Co.	St. Louis, Mo.	
WEV	Hurlburt-Still Electrical Co.,	Houston, Tex.	360
WEW	St. Louis University.	St. Louis, Mo.	261
WFAA	Dallas News and Dallas Journal,	Dallas, Tex.	476
WFAB	Carl F. Woese.	Syracuse, N. Y.	234
WFAF	H. C. Spratley Radio Co.,	Poughkeepsie, N. Y.	
WFAG	Radio Engineering Laboratory,	Waterford, N. Y.	
WFAH	Electric Supply Co.,	Port Arthur, Tex.	
WFAJ	Hi-Grade Wireless Instrument Co.,	Asheville, N. C.	
WFAM	Times Publishing Co.,	St. Cloud, Minn.	
WFAN	Hutchinson Electric Service Co.,	Hutchinson, Minn.	360
WFAQ	Missouri Wesleyan College and Cameron Radio Co.	Cameron, Mo.	
WFAT	Daily Argus-Leader,	Sioux Falls, S. D.	360
WFAV	University of Nebraska,	Lincoln, Neb.	360
WFI	Strawbridge & Clothier,	Philadelphia, Pa.	395
WGAL	Lancaster Electric Supply & Construction Co.	Lancaster, Pa.	248
WGAN	Cecil E. Lloyd.	Pensacola, Fla.	
WGAQ	Glenwood Radio Corporation (W. G. Patterson)	Shreveport, La.	

(Continued on next page)

NUMERICAL RELATIONS BETWEEN LETTERS OF THE ALPHABET

By H. O. Bernstrom

THE purpose which an article of this sort, based on the numerical relations of the letters used in the English language, can serve is not necessarily confined within narrow limits.

The first column of the table presented, gives the letters in their descending order of importance in numerical terms for letters used in words. It is seen that while "e" is used 154.3 times, "t" is used 140 times, etc.

The second column gives the order of the letters occurring as first letters of words. The number of words from which these relations were derived, was about 140,000, representing the words in the English dictionary. The numerical relation is transformed to a basis equal to a unit of the first column, so that it can be observed that "S" is used 201 times (see second column) as the first letter of a word when it is used as a letter in a word 91.3 times (see first column), or when X is used 1.5 times (see second column), as the first letter in a word.

The letters in the third column illustrate their order of occurrence as first letters of proper nouns. The source for this comprised catalogs and directories, including about 440,000 proper nouns. Similar observations, as described before can now be obtained with the use of all three columns. For instance: "S" is used as a first letter in proper nouns 169.2 times when it is used 201 times as a first letter in a word. It may appear now, in order to get the representative numerical relation, that these three columns should be combined and the numerical relation be thus obtained. This is not the case, because column one gives the order of importance of the letters as used in words, whether as first letters in proper nouns or otherwise.

TABLE OF NUMERICAL OCCURRENCE OF LETTERS OF THE ALPHABET IN THE ENGLISH LANGUAGE

IN WORDS		AS FIRST LETTER		AS FIRST LETTER IN PROPER NOUNS		ORDER GIVEN BY POE
Letter	No.	Letter	No.	Letter	No.	Letter
e	154.3	S	201.0	S	169.2	e
t	140.0	C	165.0	M	148.3	a
o	108.3	P	142.0	B	129.16	o
a	100.00	A	108.0	C	98.3	i
i	99.00	D	99.5	H	95.0	d
s	91.3	T	94.0	G	87.5	h
n	85.0	B	90.0	R	84.2	n
r	82.6	M	81.5	W	82.5	r
h	64.6	R	80.0	L	80.0	s
l	44.0	F	72.5	F	70.5	t
u	38.6	I	71.0	K	69.2	u
d	38.0	E	70.0	P	64.16	y
c	37.6	H	61.0	A	62.5	c
w	30.3	L	57.5	D	59.16	f
f	26.3	G	55.0	N	41.6	g
p	25.3	W	49.5	T	40.0	l
m	23.0	O	40.0	E	37.5	m
g	23.0	V	30.0	J	24.16	w
y	19.6	U	29.5	O	21.6	b
b	19.0	N	27.5	V	15.8	k
v	10.3	K	12.5	I	14.16	p
k	6.7	J	12.5	U	10.0	q
x	3.3	Q	10.0	Z	9.2	x
j	0.7	Y	5.5	Y	5.8	z
z	0.7	Z	4.5	Q	3.3	v
q	0.7	X	1.5	X	0.3	j

Poe's order in his "The Gold Bug," as a matter of interesting comparison, is given in the fourth column. He did not give complete numerical relations and he also omitted the letters "v" and "j", which have been added on to his list in the order of their importance as determined in this investigation.

In concluding, it is evident that the first column represents the numerical order of importance of the letters of the English language in words, and if a bold spirit were to initiate the idea of an alphabetical rearrangement, we would refer to our A B C's as our E T O's.

Call	Name	City and State	Wave-Lengths
WGAR	Southwest American,	Fort Smith, Ark.	360
WGAU	Radio Mfg. and Service Co. (Marcus G. Limb)	Wooster, Ohio	226
WGAW	Ernest C. Albright	Altoona, Pa.	261
WGAX	Radio Electric Co.,	Washington Court House, Ohio,	
WGAY	Northwestern Radio Co.,	Madison, Wis.	
WGAZ	South Bend Tribune,	South Bend, Ind.	
WGF	The Register and Tribune,	Des Moines, Iowa	360
WGI	American Radio & Research Corp.,	Medford Hillside, Mass.	
WGL	Thomas F. J. Howlett,	Philadelphia, Pa.	
WGM	Atlanta Constitution	Atlanta, Ga.	
WGR	Federal Telephone & Telegraph Co.,	Buffalo, N. Y.	
WGV	Interstate Electric Co.,	New Orleans, La.	360
WGY	General Electric Co.,	Schenectady, N. Y.	380
WHA	University of Wisconsin,	Madison, Wis.	360
WHAA	State University of Iowa,	Iowa City, Iowa	283
WHAB	Clark W. Thompson,	Galveston, Tex.	
WHAC	Cole Bros. Electric Co.,	Waterloo, Iowa	
WHAD	Marquette University,	Milwaukee, Wis.	280
WHAG	University of Cincinnati,	Cincinnati, Ohio	222
WHAH	Hafer Supply Co.	Joplin, Mo.	
WHAI	Radio Equipment & Manufacturing Co.	Davenport, Iowa	
WHAK	Robert Hardware Co.,	Clarksburg, W. Va.	
WHAL	Lansing Capital News,	Lansing, Mich.	248
WHAM	University of Rochester (Eastman School of Music)	Rochester, N. Y.	360
WHAO	Frederic A. Hill	Savannah, Ga.	
WHAP	Otta & Kuhns	Decatur, Ill.	
WHAQ	Semmes Motor Co.,	Washington D. C.	
WHAR	Paramount Radio & Electric Co. (W. H. A. Paulus),	Atlantic City, N. J.	
WHAS	Courier-Journal and Louisville Times,	Louisville, Ky.	400
WHAV	Wilmington Electrical Specialty Co.,	Wilmington, Del.	
WHAY	Huntington Press,	Huntington, Ind.	380
WHAZ	Rensselaer Polytechnic Institute,	Troy, N. Y.	
WHB	Sweeney School Co.,	Kansas City, Mo.	411
WHD	West Virginia University,	Morgantown, W. Va.	
WHK	Radiovox Co. (Warren R. Cox),	Cleveland, Ohio	
WHN	Ridgewood Times Printing & Publishing Co.	Ridgewood, N. Y.	360
WIAB	Joslyn Automobile Co.	Rockford, Ill.	252
WIAC	Galveston Tribune	Galveston, Tex.	360
WIAD	Ocean City Yacht Club,	Ocean City, N. J.	254
WIAF	Gustav A. DeCortin,	New Orleans, La.	234
WIAH	Continental Radio & Manufacturing Co.	Newton, Iowa	
WIAI	Heer Stores Co.	Springfield, Mo.	360
WIAJ	Fox River Valley Radio Supply Co. (Quinn Bros.)	Neenah, Wis.	224
WIAK	Journal-Stockman Co.	Omaha, Neb.	278
WIAO	School of Engineering of Milwaukee and Milwaukee News,	Milwaukee, Wis.	
WIAQ	Chronicle Publishing Co.,	Marion, Ind.	
WIAR	Paducah Evening Sun,	Paducah, Ky.	
WIAS	Home Electric Co.	Burlington, Iowa	
WIAT	Leon T. Noel	Tarkio, Mo.	
WIAU	American Trust & Savings Bank,	Le Mars, Iowa	
WIAV	New York Radio Laboratories,	Binghamton, N. Y.	
WIAW	Saginaw Radio & Electric Co.,	Saginaw, Mich.	
WIAY	Woodward & Lothrop,	Washington, D. C.	360
WIK	K. & L. Electric Co.,	McKeesport, Pa.	
WIL	Continental Electrical Supply Co.,	Washington, D. C.	
WIP	Gimbel Bros.	Philadelphia, Pa.	509
WIZ	Cino Radio Manufacturing Co.,	Cincinnati, Ohio	
WJAB	American Electric Co.,	Lincoln, Neb.	
WJAD	Jackson's Radio Engineering Laboratories	Waco, Tex.	
WJAF	Press Publishing Co.	Muncie, Ind.	
WJAG	Norfolk Daily News	Norfolk, Neb.	360
WJAJ	Young Men's Christian Association,	Dayton, Ohio	
WJAK	White Radio Laboratory,	Stockdale, Ohio	360
WJAM	D. M. Perham	Cedar Rapids, Iowa	
WJAN	Peoria Star	Peoria, Ill.	280
WJAP	Kelley-Duluth Co.	Duluth, Minn.	
WJAQ	Capper Publications	Topeka, Kan.	
WJAR	The Outlet Co.	Providence, R. I.	
WJAS	Pittsburgh Radio Supply House,	Pittsburgh, Pa.	

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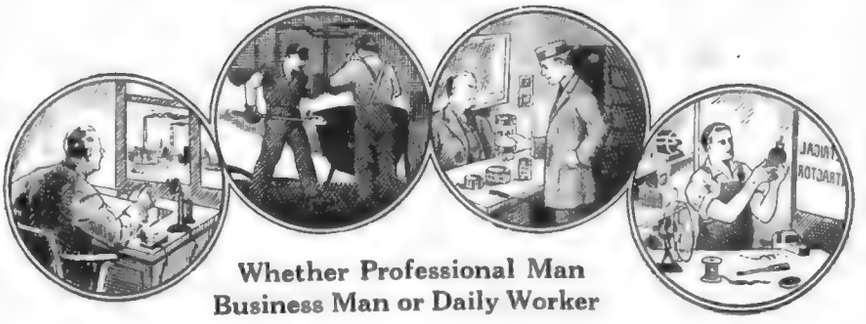

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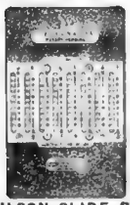

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WJAZ	Chicago Radio Laboratory,	Chicago, Ill.	448
WJD	Richard H. Howe	Granville, Ohio	229
WJH	White & Boyer Co.,	Washington, D. C.	263
WJX	De Forest Radio Telephone & Telegraph Co.	New York, N. Y.	
WJY	Radio Corporation of America,	New York, N. Y.	405
WJZ	Radio Corporation of America,	New York, N. Y.	455
WKAA	H. F. Paar	Cedar Rapids, Iowa	360
WKAC	Star Publishing Co.	Lincoln, Neb.	275
WKAD	Charles Looff (Crescent Park),	East Providence, R. I.	
WKAF	W. S. Radio Supply Co.,	Wichita Falls, Tex.	
WKAN	United Battery and Service Co.,	Montgomery, Ala.	226
WKAP	Dutee W. Flint	Cranston, R. I.	
WKAQ	Radio Corporation of Porto Rico,	San Juan, P. R.	
WKAR	Michigan Agriculture College,	East Lansing, Mich.	280
WKAS	L. E. Lines Music Co.,	Springfield, Mo.	
WKAV	Laconia Radio Club,	Laconia, N. H.	
WKAW	Turner Cycle Co.	Beloit, Wis.	242
WKAX	William A. McFarlane,	Bridgeport, Conn.	231
WKAY	Brenau College	Gainsville, Ga.	
WKC	Joseph M. Zamoiski Co.,	Baltimore, Md.	
WKY	WKY Radio Shop.	Oklahoma, Okla.	
WLAC	North Carolina State College,	Raleigh, N. C.	
WLAG	Cutting & Washington Radio Corp.,	Minneapolis, Minn.	417
WLAH	Samuel Woodworth.	Syracuse, N. Y.	360
WLAJ	Waco Electrical Supply Co.,	Waco, Tex.	360
WLAK	Vermont Farm Machine Corp.,	Bellows Falls, Vt.	
WLAL	Tulsa Radio Co.	Tulsa, Okla.	
WLAN	Putnam Hardware Co.	Houlton, Me.	
WLAP	W. V. Jordan	Louisville, Ky.	
WLAQ	Arthur E. Schilling,	Kalamazoo, Mich.	
WLAT	Radio & Specialty Co.,	Burlington, Iowa	
WLAV	Electric Shop	Pensacola, Fla.	
WLAW	Police Dept., City of	New York, N. Y.	
WLAX	Putnam Electric Co. (Greencastle Community Broadcasting Station),	Greencastle, Ind.	231
WLAY	Northern Commercial Co.,	Fairbanks, Alaska	
WLAZ	Hutton & Jones Electric Co.,	Warren, Ohio	248
WLB	University of Minnesota,	Minneapolis, Minn.	360
WLW	Crosley Manufacturing Co.,	Cincinnati, Ohio	309
WMAB	Radio Supply Co.	Oklahoma, Okla.	
WMAC	J. E. Page (Olive B. Meredith),	Cazenovia, N. Y.	261
WMAD	Atchinson County Mail,	Rock Port, Mo.	
WMAF	Round Hills Radio Corporation,	Dartmouth, Mass.	
WMAH	General Supply Co.	Lincoln, Neb.	254
WMAJ	Drovers Telegram Co.,	Kansas City, Mo.	275
WMAK	Norton Laboratories,	Lockport, N. Y.	360
WMAL	Trenton Hardware Co.,	Trenton, N. J.	256
WMAM	Beaumont Radio Equipment Co.,	Beaumont, Tex.	
WMAN	Broad Street Baptist Church,	Columbus, Ohio	286
WMAP	Utility Battery Service.	Easton, Pa.	246
WMAQ	Fair Corp. and Chicago Daily News,	Chicago, Ill.	448
WMAT	Paramount Radio Corporation,	Duluth, Minn.	266
WMAV	Alabama Polytechnic Institute,	Auburn, Ala.	250
WMAW	Wahpeton Electric Co.,	Wahpeton, N. D.	
WMAY	Kingshighway Presbyterian Church,	St. Louis, Mo.	
WMAZ	Mercer University	Macon, Ga.	268
WMC	Commercial Appeal.	Memphis, Tenn.	500
WMH	Precision Equipment Co.,	Cincinnati, Ohio	248
WMU	Doubleday-Hill Electric Co.,	Washington, D. C.	261
WNAB	Park City Daily News,	Bowling Green, Ky.	
WNAC	Shepard Stores	Boston, Mass.	
WNAD	University of Oklahoma,	Norman, Okla.	
WNAL	R. J. Rockwell	Omaha, Neb.	
WNAM	Ideal Apparatus Co.	Evansville, Ind.	
WNAN	Syracuse Radio Telephone Co.,	Syracuse, N. Y.	286
WNAP	Wittenberg College,	Springfield, Ohio	
WNAQ	Charleston Radio Electric Co.,	Charleston, S. C.	
WNAR	C. C. Rhodes	Butler, Mo.	

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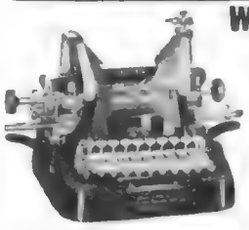

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31x4	2.75	.90	35x4½	4.25	1.65
32x4	3.00	1.40	36x4½	4.25	1.65
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WNAT	Lennig Bros. Co.	Philadelphia, Pa.	
WNAV	Peoples Telephone and Telegraph Co.	Knoxville, Tenn.	
WNAW	Peninsular Radio Club,	Fort Monroe, Va.	
WNAX	Dakota Radio Apparatus Co.,	Yankton, S. D.	244
WNAY	Ship Owners Radio Service,	Baltimore, Md.	
WNJ	Shotton Radio Manufacturing Co.,	Albany, N. Y.	
WOAA	Dr. Walter Hardy	Ardmore, Okla.	
WOAB	Valley Radio	Grand Forks, N. D.	
WOAC	Maus Radio Co.	Lima, Ohio	266
WOAD	Friday Battery & Electric Corporation	Sigourney, Iowa	
WOAE	Midland College	Fremont, Neb.	
WOAF	Tyler Commercial College,	Tyler, Tex.	
WOAG	Apollo Theatre (Belvidere Amusement Co.)	Belvidere, Ill.	224
WOAH	Palmetto Radio Corporation,	Charleston, S. C.	
WOAI	Southern Equipment Co.,	San Antonio, Tex.	385
WOAJ	Ervins Electrical Co.,	Parsons, Kan.	258
WOAK	Collins Hardware Co.,	Frankfort, Ky.	240
WOAL	William E. Woods,	Webster Groves, Mo.	
WOAN	Vaughn Conservatory of Music,	Lawrenceburg, Tenn.	
WOAO	Lyradion Manufacturing Co.,	Mishawaka, Ind.	
WOAP	Kalamazoo College,	Kalamazoo, Mich.	
WOAQ	Portsmouth Kiwanis Club,	Portsmouth, Pa.	360
WOAR	Henry P. Lundskow,	Kenosha, Wis.	
WOAS	Bailey's Radio Shop,	Middletown, Conn.	
WOAT	Boyd M. Hamp	Wilmington, Del.	
WOAV	Pennsylvania National Guard, 112th Infantry, 2d Battalion,	Erie, Pa.	242
WOAW	Woodmen of the World,	Omaha, Neb.	526
WOAX	Franklyn J. Wolff (Monument Pottery Co.)	Trenton, N. J.	240
WOAZ	Penick Hughes Co.	Stamford, Tex.	
WOC	Palmer School of Chiropractic,	Davenport, Iowa	484
WOE	Buckeye Radio Service Co.,	Akron, Ohio	
WOI	Iowa State College	Ames, Iowa	360
WOK	Pine Bluff Co.	Pine Bluff, Ark.	
WOO	John Wanamaker	Philadelphia, Pa.	509
WOQ	Western Radio Co.,	Kansas City, Mo.	360
WOR	L. Bamberger & Co.,	Newark, N. J.	405
WOS	Missouri State Marketing Bureau,	Jefferson City, Mo.	
WPAB	Pennsylvania State College,	State College, Pa.	
WPAC	Donaldson Radio Co.,	Okmulgee, Okla.	
WPAD	W. A. Wieboldt & Co.,	Chicago, Ill.	
WPAF	Peterson Radio Co.,	Council Bluffs, Iowa	
WPAH	Wisconsin Department of Markets,	Waupaca, Wis.	360
WPAJ	Doolittle Radio Corporation,	New Haven, Conn.	268
WPAK	North Dakota Agricultural College,	Agricultural College, N. D.	
WPAL	Superior Radio & Telephone Equipment Co.	Columbus, Ohio	286
WPAM	Auerbach & Guettel	Topeka, Kan.	
WPAP	Theodore D. Phillips,	Winchester, Ky.	
WPAQ	General Sales & Engineering Co.,	Frostburg, Md.	
WPAR	Ward Battery & Radio Co.,	Beloit, Kan.	
WPAS	J. & M. Electric Co.,	Amsterdam, N. Y.	
WPAT	St. Patricks Cathedral,	El Paso, Tex.	
WPAU	Concordia College,	Moorehead, Minn.	
WPAW	Radio Installation Co.,	Wilmington, Del.	
WPAY	Bangor Radio Laboratory,	Bangor, Me.	
WPAZ	Dr. John R. Koch,	Charleston, W. Va.	273
WPG	Nushawg Poultry Farm,	New Lebanon, Ohio	
WPI	Electric Supply Co.	Clearfield, Pa.	
WQAA	Horace A. Beale, Jr.,	Parkesburg, Pa.	
WQAB	Southwest Missouri State Teachers College	Springfield, Mo.	236
WQAC	E. B. Gish	Amarillo, Tex.	
WQAD	Whitall Electric Co.,	Waterbury, Conn.	242
WQAE	Moore Radio News Station,	Springfield, Vt.	275
WQAF	Sandusky Register	Sandusky, Ohio	240
WQAH	Brock-Anderson Electrical Engineering Co.	Lexington, Ky.	254
WQAJ	Ann Arbor Times News,	Ann Arbor, Mich.	
WQAK	Appel-Higley Electric Co.,	Dubuque, Iowa	
WQAL	Coles County Telegraph Co.,	Mattoon, Ill.	258

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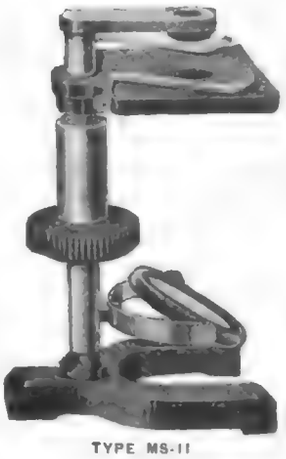

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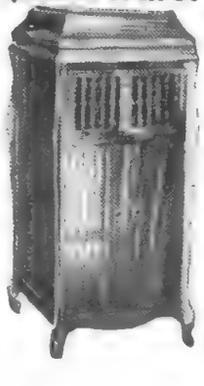

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WQAW	Catholic University,	Washington, D. C.	236
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WRK	Doron Bros. Electric Co.,	Hamilton, Ohio	
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WRM	University of Illinois	Urbana, Ill.	
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WRR	City of Dallas, Police and Fire Signal Department	Dallas, Tex.	
WRW	Tarrytown Radio Research Laboratory	Tarrytown, N. Y.	273
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WWZ	John Wanamaker,	New York, N. Y.	507

Dr. Hackensaw's Secrets

By CLEMENT FEZANDIE.

(*Continued from page* 539)

Each signal is alike in strength, but as my distance from earth increases, the signal is weaker and weaker when it reaches me, hence moves the needle of the dial a lesser distance. This tells me my distance from earth. An automatic counter subtracts the distance the preceding second from the last distance and hence gives the speed per second, or more strictly speaking, the speed during the last second."

"I see"—

"I am now going to open the shutters and take a look at the sky."

As he said the words, the doctor threw open a slide, and Pep put her eye to the end of the telescope. This was by no means easy to do, for, of course she could not stand, her body floating in the air as it would float in water. When she did finally manage to look through the instrument, however, she gave a cry of surprise:

"Why, it's already night-time!" she exclaimed. "That gets my goat! I thought we left the earth only a few minutes ago! But it's dark as pitch outside, and the stars are out, and they're turning around in the sky as if all the hootch in New York had been sent up there. And what in the world is that immense light over there like an enormous moon! Why it must be the earth—see those dark spots—that must be North America, Gee! how quickly its moving! The whole earth is out of sight now! What in the world is the matter?"

"I think I can explain," said Doctor Hackensaw quietly. "Our diffused daylight on earth is due to our atmosphere. Here in the car, or even on the moon, when we reach it, the sky will be black even in the day-time. The sun will be a very brilliant circle of light, but the rest of the sky will be black. It will appear to us like perpetual night!"

"Here comes the earth back again!" cried Pep—"What makes it act that way."

"It is our car that is spinning around!" explained the doctor. "Every time we pull one of the straps on the side of the car we set the whole car spinning around, just as a squirrel does in a rotary cage. My internal car as I told you, is free to revolve inside an outer shell, but the act of opening the slide to the telescope joins the two shells, so the two shells revolve together—otherwise we couldn't use the telescope at all. However we can slow up the revolution of the car by pulling a strap in the opposite direction. But now, Miss Pep, don't you think we'd better attend to the department of the interior. Aren't you hungry?"

Pep was always ready for eats, and was gratified when the doctor took from a fireless cooker a meal that would have sufficed for half a dozen persons.

"What shall we do with the garbage, doc?" she asked, after the meal was finished, holding up a paper bag containing the bones, etc., left from the feast. Shall I throw them overboard?"

Doctor Hackensaw hesitated a moment, then said: "Very well. I'll open the window for just a second, so as not to allow too much air to escape; be ready, and throw the bag out quickly."

Suiting the action to the word, he opened the casement and the young girl hurled the paper package forth with all her might. Away it sped as if shot from a cannon, and, lighted up by the sun's rays, it looked for all the world like a shooting-star, until a new revolution of the car hid it from

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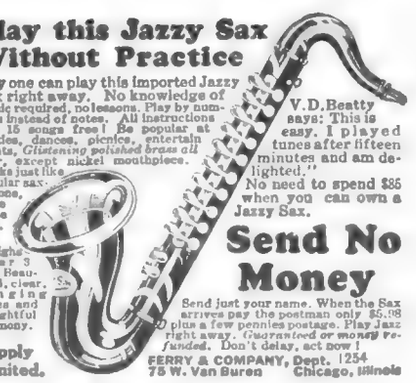

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sight. It reappeared again in a moment or two, as the car came around, but fainter and further away.

"Gee!" cried the astonished girl, "I knew I was a good pitcher all right, but I didn't know I could throw anything so fast or so far! That bag must be a couple of miles away now! And it isn't falling to the earth, either. I suppose its because it hasn't any weight that I can throw it so far?"

"Precisely," replied the doctor. "The same force will move a body sixteen times as fast when it has no weight, as it would move it against the attraction of the earth. And the body will keep on moving forever unless stopped by some resistance. That is why all our motions in the car are so violent. One's muscles retain their accustomed power, but there is no weight to be moved, merely the force required to move the mass of matter that composes our arms and legs, for mass and weight are no longer identical here."

"But how is it that objects in the car have no weight if we're only six thousand miles away from the earth? The attraction of the earth and moon cannot be equal yet?"

"No indeed. The earth's attraction is about one hundred times that of the moon, so the half-way place, if I may call it so, is very near the moon. But the reason bodies in the car have no weight is that they are traveling at the same speed as the car, hence their relative positions are not affected by gravitation. Shoot two bullets at the moon with the same speed, and the second will not catch up with the first. We ourselves are one bullet and the car is the other. We are traveling now at the same speed, and if we hung in mid-air in the car we should remain there during the whole trip. The condition is exactly the same as if a car with a passenger were allowed to fall from one part of the earth to the antipodes, through a tunnel bored through the center of the earth. Objects in the car then, as in the present instance, would appear to have lost all their weight. The package of rubbish you threw from the car shows the same thing. It, too, was traveling at the speed of the car, and will never return to earth again. As a matter of fact, it will reach the moon, but several hundred miles away from the point where we shall land. You will have thrown it really more than a thousand miles!"

"Gee!" cried Pep, delighted. "Then I've broken all records for pitching!"

"If you had been awake when the car started," continued Doctor Hackensaw, you would have noticed another curious fact. Owing to the tremendous resistance of the air during the first few seconds of our flight, the car was considerably retarded, while we, had we been suspended in the air inside, were not so retarded. The effect would have been the same as if we had weighed thousands of pounds instead of nothing, as we do at present."

"At what speed did we start?" asked Pep.

"The centrifugal wheel gave us a speed of seven miles per second in one direction, the revolution of the earth around the sun gave us a speed of nine miles per second in another direction, and the rotation of the earth on its axis gave us a speed of nearly one-third of a mile per second in a third direction. By aiming the car so as to reach the moon when the lines from the earth to the sun and from the earth to the moon made a right angle at the earth, I could have obtained a speed of nine miles per second toward the moon. By aiming my Ferris wheel in the same direction, I could get seven miles per second extra, or a total speed of sixteen miles per second at the start. By aiming the wheel in the opposite direction, my speed would be only two miles per second. Combining either of these speeds with that obtained from the rotation of the

earth on its axis I could leave the earth at any speed I desired between about one and two-thirds miles per second to about sixteen and one-third miles per second."

"And of course you made this an express train, at the quickest speed?"

"Not at all. There is no hurry. And too great a speed would be dangerous, not only in passing through the atmosphere, but also when we reach the moon. If aimed straight at the moon, we should hit it too hard, while if aimed to one side of the moon, too great a speed would carry us beyond the lunar attraction."

By this time the air in the car began to become rather close, so Doctor Hackensaw proceeded to open one of the oxygen tanks. As he did so, he gave a cry of dismay.

"What's the matter?" asked Pep.

"Miss Pep," said he, solemnly, "are you a good sport. Can you stand it to learn that we are in great danger?"

"Try me and see!" replied the young girl, bravely "I just love to shiver!"

"Well, by some infernal mistake, tanks of nitrogen instead of oxygen have been put in the car. There is only one oxygen tank in the lot besides the one on tap.

"And that means?"

"And that means that we have air for one day less than our trip will require. It means that we must live a whole day without breathing." And Doctor Hackensaw looked grim. It was nothing to him to face death, but the idea of being the innocent cause of this young lady's death unmanned him.

But Pep was game. Only a more rapid coming and going of her breath showed that she was affected by the news. "Is there nothing we can do?" she asked.

"I see nothing," replied the doctor, "unless. . . ." Suddenly his face brightened: "I have it!" he cried. "I think we can save ourselves yet!"

"How so?"

"A sleeping person requires less air than one who is awake. We must sleep during the remainder of the journey. There is not a moment to lose. I shall prepare a sleeping potion at once!"

A few minutes later the doctor handed the young lady a tumbler half full of a rose-tinted liquid.

"Drink this," said he, "and then fasten yourself in your couch. I have calculated the dose so it will keep us asleep until a couple of hours before we land on the moon. I must be wide awake then, at all hazards."

"Will the landing on the moon be dangerous?" asked Pep, innocently, as she raised the glass to her lips and drained its contents, while the doctor quaffed his potion at the same time.

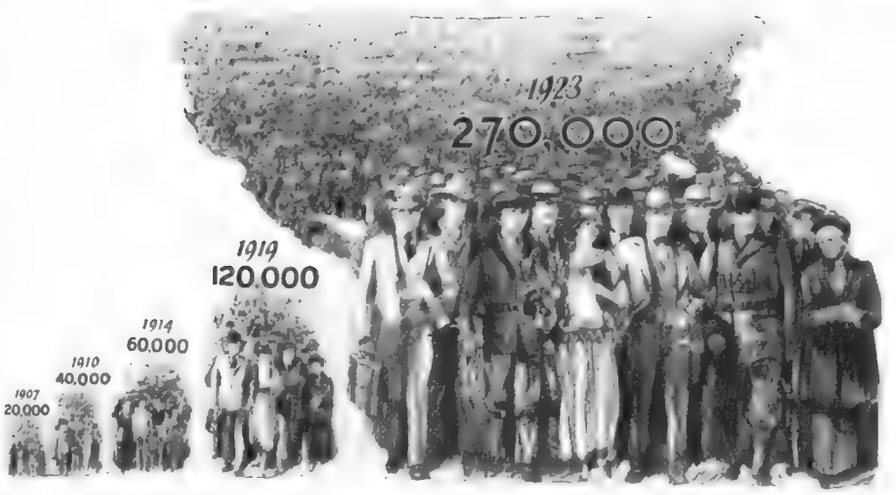
"Dangerous?" echoed the doctor, as he stepped into his couch. "My dear young lady, is it possible that you don't realize that the car is bound to strike the moon with considerable force. It is true the moon is smaller than the earth, and less dense, hence its attractive power is smaller, but on the other hand, it has no atmosphere to retard our fall. The chances are that we shall fall with such velocity that we shall reach the moon as flat as pancakes—and pretty badly burnt pancakes at that!

(*To be continued*)

FLYING MAIL TRAIN

A "flying mail train" is the latest type of airplane to be developed in England. In the plane's mail chamber, sorters will be able to carry on their work just as they might in a railway mail train. It will have a radius of 2,000 miles and will be able to stay in the air twenty-four hours, without alighting.

The machine will virtually fly itself and all the helmsman will have to do will be to keep it on a compass course by means of the rudder.



These groups of stockholders illustrate the rapid growth in ownership of the Bell System.

A Community of Owners Nation-wide

"Who owns the company?" "What is behind it?" These questions are asked in appraising the soundness of a business and in determining its aims.

The American Telephone and Telegraph Company is owned by more than 270,000 people living in every state in the Union. Could the stockholders of the Bell System be gathered to one place, they would equal the population of a city about the size of Providence or Denver.

They constitute a representative cross-section of American citizenship. Among them, of course, are bankers and men of large affairs; for the idea of ownership in the Bell System appeals to sound business judgment and a trained sense of values.

In this community of owners are the average man and woman, the storekeeper, the clerk, the salesman, the professional man, the farmer and the housewife—users of the telephone who with their savings have purchased a share in its ownership. The average individual holding is but twenty-six shares.

No institution is more popularly owned than the Bell System, none has its shares distributed more widely. In the truest sense it is owned by those it serves.

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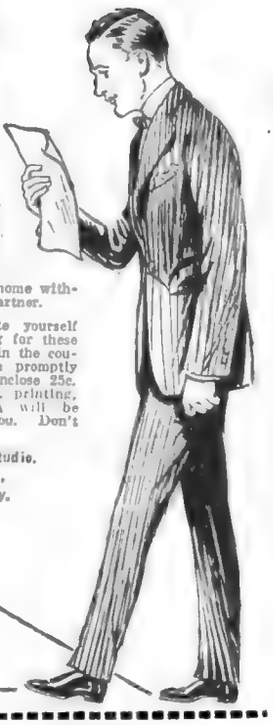

Why Good Dancers Are Popular

Isn't it foolish for a person not to be a good dancer? Are not the best dancers the most popular members of your set?

Good dancers never lack partners and are always invited to every affair because dancing is the most popular form of amusement and really good dancers are in demand all the evening.

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Arthur Murray, Studio 838,
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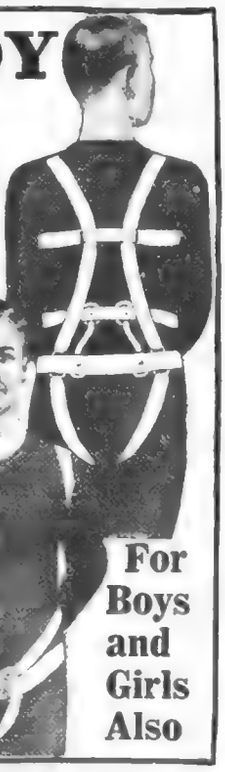

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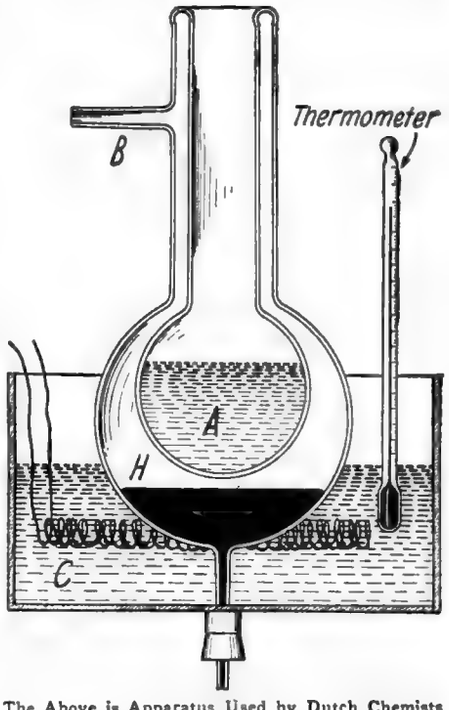
ANALYSIS SHOWS ELEMENTS TO HAVE MANY ATOMIC WEIGHTS

By PROF. LINDLEY PYLE

MR. F. W. ASTON, physicist and chemist of Cambridge, England, has recently been awarded a Nobel prize for his researches on the atomic weights of the elements. His work with certain vacuum tube phenomena has verified what was suspected before, that the atoms of any given element are not necessarily alike in weight although they do have identical chemical properties. Professor Soddy had already found that lead from uranium ore is about ten per cent lighter in atomic weight than the lead obtained from thorium ore element. Dr. Aston has found two isotopes, as the different parts of the element are called, of chlorine. Ordinary chlorine consists of a mixture of two kinds of chlorine, all the atoms of one group having an atomic weight of 35 (compared to oxygen 16), and all the atoms of the other group



The Above is Apparatus Used by Dutch Chemists to Obtain Mercury Isotopes. The Mercury (H) is Boiled in the Vacuum Envelope of a Thermos Bottle by Immersing Bottle in Electrically Heated Oil. The Lighter Isotope Comes Off First and Freezes Against the Inside of the Bottle Containing Liquid Air. Residue is Then Poured Off and Frozen Product Allowed to Drip Back. Isotopes Obtained Thus Differed One-Half of One Per Cent. in Atomic Weight.

having an atomic weight of 37. The two groups are present in such proportions that the average atomic weight is 35.46—a figure that the chemist has heretofore accepted as the atomic weight of a one-kind-only atom of chlorine. It is found that the atomic weight difference between isotopes does not arise from a difference in size of the atoms but from a variation in mass of the tiny nucleus at the center of the atom. The isotopes of any given element are identical chemically and cannot be separated by strictly chemical methods.

The separation of isotopes being *chemically* impossible, any separation must depend upon *mechanical* methods founded upon the properties of mass.

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

RHEOSTAT

(732) Fred Schrieber, Sault St. Marie, Mich., has designed a rheostat which will control the current more gradually than the ordinary types. This is very simply constructed. He requests our advice.

A. Your idea seems to be meritorious, but before advising a patent on the same, we would suggest that you build a working model of the rheostat and test it out camparatively with other rheostats now found on the market. A comparative test is absolutely necessary. We do not hold that this finer graduation near one end of the rheostat is necessary, but the suggestion is worthy of further development.

LAUNDRY MARKER

(733) John Throp Wellbourn, New Wilmington, Penn., asks for our advice on a laundry marker made in the form of a button, which is to be clipped to the garments.

A. We do not see what advantage your laundry marker possesses over other devices now found on the market. It stands to reason that a marker of this nature if intended for laundry that is to be washed, would not only damage the material, but would also create a lot of trouble in attempting to remove the same from the garments. It produces a button-like effect which is liable to cut the individual upon whose articles the same is secured, and if made of non-rusting or non-tarnishing metal will be expensive. It cannot compete with India ink for wet wash; is more difficult to place on the object, and is ruinous. We do not advise a patent on the same.

ELECTRICITY FROM WATER

(734) J. C. Mangan, Portland, Oregon, writes, "In your July issue you published an article on 'Electricity From Sea Water'—I cannot understand how this is to work. Can I submit some ideas?"

A. With reference to the power machine described in the July issue of our magazine, we would advise that this device although scientifically possible, is very poor practically, an engineer having figured out that the maximum efficiency which such a machine could develop, is about .3%, which by the time all friction is overcome, causes the machine to remain at a standstill. We will be very glad indeed to receive your ideas, and give "patent advice" on the same. The scheme is susceptible of development and may prove practical in some other form at some future date. We published the idea for what it was worth. It possesses the germ of future possibilities.

ADAPTOR SOCKET AND RHEOSTAT COMBINATION

(735) Victor J. Humbrecht, Yardley, Pa., requests our advice on a very clever rheostat and adaptable socket combination, with a well designed additional 25-ohm rheostat placed into the circuit for low voltage tubes.

A. With regard to your rheostat, We would advise that although the idea presents a reasonable possibility of sale, the manufacturing of the same is more or less of a hazard. Most of the individuals who are purchasing and using U. V. 199's have no storage battery, and consequently the 25-ohm resistance element would have no particular use. The only place such a socket would be of value, would be in amplifying circuits where the individual desires to use a low voltage tube in the detector circuit in addition to his six volt tubes.

We doubt that a patent on the same will enable you to sell the device, although we are of the impression that should you place it on the market, you will be fairly well repaid for your trouble. It necessitates your actually manufacturing the device, however, in order to effect financial returns.

TROUSER HANGER

(736) C. W. Jackson, San Francisco, Calif., submits a sketch of a trouser hanger and asks our opinion on the same. It is convoluted and made of a single piece of wire or ribbon.

A. Your hanger for men's trousers is not such a remarkable novelty that it would warrant the expenditure of several hundred dollars in order to patent it and further develop it. You have given us no information regarding the width of the steel spring band which is to hold the trousers, and how this is to be employed.

There are many skirt hangers on the market with a duplex clip and a holder, far superior to your device, which are likewise employed by many men in hanging up their trousers, and which hold these trousers in an upright position, placing the seams in their proper position.

We would advise careful investigation before endeavoring to put your hanger upon the market, and suggest that you investigate the device from the angle of its worthlessness rather than its worthiness.

INVENTIVE COURSES

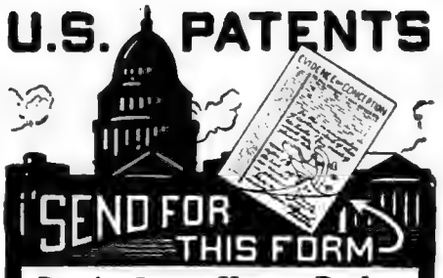
(737) R. E. Benson, Deer Lodge, Montana, asks several questions regarding our aim in conducting the patent advice columns, and asks advice regarding inventive courses. The questions are made clear by the answers to them here given.

A. SCIENCE AND INVENTION MAGAZINE makes it a duty to give advice to inventors like yourself, for which a charge of $1.00 is made if a personal letter is requested, no charge if the answer is to be printed. This advice covers nearly every conceivable angle of the patent subject.

With reference to the course of which you speak, its originator is quite well known through his previous connections, as well as his present associations. He is, we believe, a free lance author, and was at one time editor of a small magazine dealing with mechanical subjects. He is likewise the author of several books.

Needless to say, no course in inventive science can make you an inventor. This depends on your own foresight, and your own ability. It can but assist you with your present ideas. This course will not tell you what is wrong with your invention.

U.S. PATENTS



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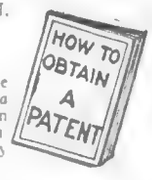

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(WRITE PLAINLY)

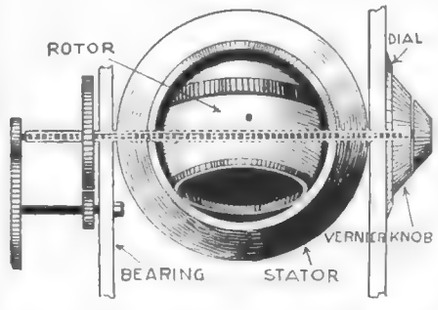
You have been correctly informed by a lawyer that the only way to find out if your invention is patentable is to have a patent search made on the idea. The prices of a search vary, ranging from $5.00 to $15.00. Ten dollars is a reasonable price. This means that each one of your ideas, in order to be investigated, will necessitate an expenditure of $10.00. This is the only possible way of assuring yourself that your suggestion has not been previously patented, unless you yourself desire to look through the patent files, and then, not knowing the classifications under which these patents appear, you would have difficulty in finding the patents which approach your idea.

It is of no value to protect yourself by means of priority claims unless you actually reduce the invention to practice, viz., building a working model of the same. The mere fact that you do not attempt to put this on the market because of a lack of funds will not protect you. It is up to you to find the necessary funds, and consequently any priority claims which you may have established are of no value unless the device is being sold. If, on the other hand, you should attempt to patent your idea, and find that some one else is attempting to secure a patent on a similar scheme, your priority claims will prove of immense value, provided that the dates on them precede those which the other inventor furnishes. Pleading poverty will not enable you to attach the property of some other inventor.

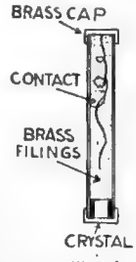
If you care to submit any of your ideas to us for more direct advice, we will be very glad to comment upon the same.

RADIO PATENTS

(738) H. B. Conant, Ouray, Colo., asks whether we would advise a patent on a new type of inductance for radio circuits, wound in layers in a combination inductive and non-inductive winding. He also requests our advise on a variometer vernier rotor shown in the illustration here, and a crystal detector likewise illustrated. The crystal detector is of the filings type.



Above is Shown a Gear Device For Obtaining Highly Selective Tuning With a Plain Variometer by Means of Reducing the Torque of the Shaft and Knob Through a Series of Gears. To the Right is Shown an Adaptation of the Turney Method of Mounting Crystals Used as Radio Detectors. Querist asks if the Two Ideas are Patentable.



A. Your first idea for a new type of inductance for radio purposes is not as new as you think. We have received some combination coils of this nature from France which are, in our opinion, very similar to your design. Nevertheless, we believe you could patent the same here in this country, and in view of the fact that you are the President of a radio concern, you could market such a coil with greater ease than an individual without such connection. We believe that you should at least go the extent of having a patent search made on this.

We would certainly advise against the gearing arrangement for the variometers and vario couplers. No doubt, the construction will give very fine tuning, but it is extremely expensive, difficult to mount and takes up entirely too much room. The gears are liable to get out of order if placed on the extreme end of such a long shaft, and in general the device would be more or less unsightly. We would advise against patenting this system as well as the system for mounting crystals which latter, in our opinion, cannot be patented. It is simply the restoration of the original Turney invention patented years ago by Mr. Eugene V. Turney.

SHIP SALVAGER

(739) Cecil F. Crusen, Green Bay, Wis., requests our advice on a ship salvager made in the form of gigantic tongs, like ice tongs, which are to go down, fasten themselves around the ship and hoist it up.

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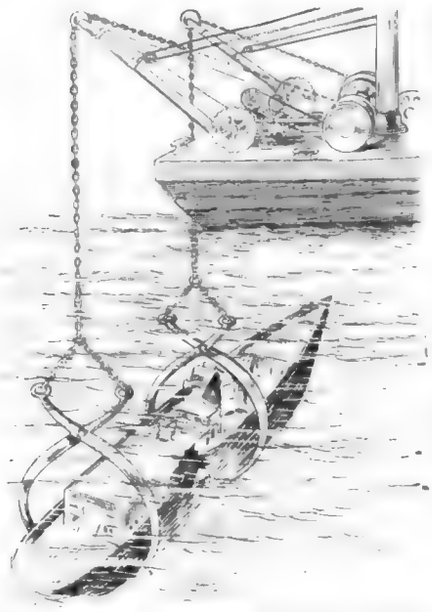
A. We frankly do not believe that the particular ship salvager which you have devised can be used practically. There are many such systems which in an attempt to place gigantic tongs around the ship and lift it up, would simply crumble the deck and in general destroy the vessel ripping it to pieces.

We doubt whether it could even be used to budge the vessel from the bottom, and what happens when the vessel is lying on the side, where it would be impossible for divers to reach it so as to apply the tongs, and where all efforts of the divers are mere haphazard guesses, is almost beyond the power of imagination. Furthermore locating the wreck and fastening the tongs is more difficult than you think.



Above is Shown an Idea Brought Forward for Salvaging Sunken Ships. Advice is Asked. The Trouble with the Idea is That the Power Exerted on the Tongs Will, Likely, Crush the Ship.

COMBINATION CIGARETTE AND MATCH

(740) Conly Clancy, Binger, Okla., asks for our advice regarding a combination cigarette and match, it being merely necessary to strike the cigarette on the side of the package and it will light.

A. Sometime ago we made a patent search on a combination cigarette and match, and found that the idea was fairly well covered by patents. Unfortunately, this suggestion is not as good as you may think it is, for the reason that should the match go out, one would have to light the cigarette as usual. On the other hand, the chemical mixture found on the head of a match, whether it is a safety match or an ordinary lucifer, seems to have a very peculiar effect on the tobacco of the cigarette. This tobacco is permeated with a sulphurous taste and odor when the two articles are placed together in close combination. At the same time when the match is lit and the smoker inhales his first puff of smoke, he will find that the products of combustion filtered through the tobacco make the cigarette taste badly. The same effect is obtained if one should light a match, and before the sulphur has had a chance to become thoroughly ignited, light the cigarette with the match. A nauseating taste is produced which will not leave the mouth for quite some time.

In view of the fact that some of the matches will go out, and that the taste of the cigarette is very poor, and further—that moisture will effect the properties of the match, and that the invention cannot be thoroughly covered, we would not suggest further action.

Upon Search, It is Found That This Idea of a Combination Match and Cigarette is Fairly Well Covered by Patents. Also the Fact That the Chemicals of the Match Have an Ill Effect on the Taste of the Tobacco.

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Around the Universe

By RAY CUMMINGS.

(*Continued from page* 541)

"Ask him about Saturn, Uranus and Neptune," the quick-witted girl said immediately.

Sir Isaac put the question as humbly and placatingly as possible.

"They are uninhabited," said the Interpreter sourly.

His Supreme Highness was making ready to depart, apparently without further interest in the proceedings. Tubby had almost managed to climb to his feet, but at last he gave it up and sank back again.

"Come on," he panted. "Let's get—out of this. . . . This ain't no place for us—we're wastin'—time again."

Without further ceremony, like little disappearing manikins in a mechanical box, the three voyagers pulled themselves back out of the doorway of their vehicle and closed the door after them. Sir Isaac rolled across the floor of the instrument room—the easiest mode of locomotion—and hoisted himself into reach of the keyboard.

An instant later the vehicle, freed from the tremendous gravitational pull of Jupiter, flew like a rifle bullet into Space.

Chapter VII

In Which the Voyagers Pass Saturn, Uranus and Neptune, and Leaving the Entire Solar System Behind Them Boldly Launch Into the Outer Realms of Interstellar Space.

AGAIN, after a voyage of some 450,000,000 miles the would-be saviours of their own world were doomed to disappointment! When they had again safely traversed the Jovian atmosphere, avoided Satellites II and IV with one of which they very nearly collided and were again launched into space, headed they cared not whither for the moment, the adventurers sat down to discuss this terrible misfortune.

As might be expected, the discussion yielded nothing. The miserable Jovian affair was most discouraging, though Tubby took a measure of satisfaction in it.

"I'm sorry for them Mercurians when they get there," he declared, with a sudden grin at the thought. "I wouldn't wish them no worse luck than askin' a favor of that Mogul guy."

"But what will we do?" Ameena asked. The brave little girl was extremely agitated as the possibility—even probability—of their final failure forced itself upon her. "Saturn, Uranus and Neptune are uninhabited! That leaves us nowhere else to go—and we *must* have help. We must!"

"I wouldn't bet a plugged nickel on anything that guy said about them other Planets," Tubby declared doggedly. "I say—let's see for ourselves. It ain't so much of a trip, is it?" Tubby, with Ameena's hand to hold most of the time, was not finding the voyage unpleasant in the least.

Ameena flashed him a look of admiration as he made this sturdy suggestion. Sir Isaac pondered.

"We are now about 485,000,000 miles from the Sun," he said thoughtfully. "Saturn's mean distance is 887,098,000 miles; Uranus is 1,784,732,000 miles, and Neptune is 2,796,528,000 miles from the Sun!"

Tubby was slightly staggered; but he tried not to show it.

"That ain't so far," he declared. "Maybe we could speed it up a little out here."

Sir Isaac, as the idea began taking hold of him, was making a swift mathematical calculation.

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"We might go past each of them without stopping to land if they are not habitable," he said finally. "Owing to their present positions it would be a trip of about 3,281,000,000 miles from here."

He added:

"That's nearly a third further than a direct route to Neptune owing to Saturn and Uranus being out of line." He showed Tubby and Ameena his chart again. "However, we ought to be able—"

"Sure thing," Tubby interrupted. "Let's get goin'. We're always wastin' so much time."

They were comparatively uneventful, the days that followed—uneventful that is, so far as Astronomical occurrences were concerned. To Tubby however, they were days of never-flagging interest. Sir Isaac, with his charts and his mathematics, concerned himself almost exclusively with navigating the vehicle. He had started on a rapidly-growing manuscript also—a sequel to the "War of the Worlds," he said; and except for a brief game of poker in the evening, he left his fellow-travelers entirely to their own devices.

Tubby and Ameena cooked the meals together, and washed the dishes; and, for relaxation sang their *Inter-planetary duets.* For the rest, Tubby held her little hand, and with his arm around her awed into silence, they watched together the never-ending vista of glorious stars toward which the vehicle was falling with constantly accelerating velocity.

Now that their voyage was extended into such gigantic distances, Sir Isaac, more than ever before, felt the need of haste. Only fifty-five days and some six hours from the time they left Jupiter remained before the fatal opposition of Mars with the Earth. Much could be accomplished in fifty-five days; but still, as Tubby lugubriously remarked, at the rate they were accomplishing it, fifty-five days was a very little time. Wherefore Sir Isaac, setting his determined jaw firmly, hurled the vehicle with prodigious velocity onward.

The danger of collision, which had so perturbed Sir Isaac in the region of Minor Planets between Mars and Jupiter was now greatly lessened. They had plenty of room now—for Asteroids, Meteors, even Comets were seldom sighted. It was a run of some 460,000,000 miles to Saturn, through a region of space comparatively deserted.

THE TRAVELERS APPROACH SATURN

At their former maximum velocity of twenty-eight million miles an hour, which Sir Isaac now maintained as an average, sixteen hours after leaving Jupiter they were approaching Saturn. It was then half-past four the following morning. Sir Isaac had slept the afternoon previous and was on watch. He awakened Tubby; and Tubby went immediately upstairs and called Ameena. Shortly afterward all three were crouched over the instrument room floor window, peering down at the great Ringed Planet above which they were seemingly poised some twelve million miles away. Sir Isaac had decreased their speed materially so that they might make observations without approaching too close.

Saturn, a globe almost as large as Jupiter, and with its marvelous system of rings very much larger, at this proximity was a magnificent sight. The globe itself—a gigantic silver disc occupying half the firmament visible through the window—had broad bands of darkened area upon it similar to those the voyagers had observed on Jupiter. But those rings! Tubby and Ameena were amazed into silence; even Sir Isaac was awed by their splendor.

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SATURN'S RINGS A GORGEOUS SIGHT

As viewed from the vehicle's present position, the concentric rings—the inner one somewhat darker—were opened up to an angle of nearly thirty degrees—a glistening, gleaming silver band, like the broad brim of a crownless hat encircling the Planet—a silver brim more than 37,000 miles broad, with a total diameter, including the sphere it encircled, of nearly 167,000 miles! Hanging there in space below them, the Planet, its rings and its several tiny moons bathed the interior of the instrument room with silver fire. It was the most glorious, most stupendous sight that human eyes had ever looked upon!

"Let us go down close," said Sir Isaac quietly.

A little later they could make out the composition of the rings with perfect clarity. Billions upon billions of tiny fragments of star-dust, each of them infinitesimal satellites, each of them like tiny moons reflecting the sunlight, whirled in their respective orbits about the mother Planet!

"The wonder of it!" Sir Isaac murmured. "A billion billion, and yet countless other billions of satellites—all on one identical plane, each separate, each holding its place and following its own circular orbit!"

Through the cloud-masses occasionally the onlookers could distinguish the surface of the Planet itself—could observe that it also was in motion, moving in gigantic whirlpools.

"It is undoubtedly entirely liquid or gaseous," said Sir Isaac, "of a density very much less than water. We shall find no inhabitants here."

"No, I 'spose not," Tubby agreed. He seemed, for once, reluctant to proceed with the journey. He sat with his arm tightly encircling Ameena's waist—as who would not, with such a girl and such a sight before one? "I guess we got to get on our way," he added with a sigh.

THE COURSE IS SET FOR URANUS

Sir Isaac altered their course; and in an hour more they were well on their way to Uranus, with Saturn and his rings high in the firmament above them.

It was a run of about eleven hundred million miles from Saturn to Uranus. Sir Isaac had already maintained an average velocity of twenty-eight million miles an hour for some hours. He now determined to better it. Beyond Saturn, he was convinced, there was still less chance of encountering any derelicts. And, with each passing hour — each passing Planet from which they hoped to obtain help for their own threatened world—the panic in their hearts grew.

It was Tubby who voiced it most strongly.

"In fifty-four days from today the Earth goes out of business," he remarked dolefully, from a deep, reflective silence into which all three had fallen.

"Fifty-four days *and* twelve hours," corrected Sir Isaac. "*If* we don't succeed."

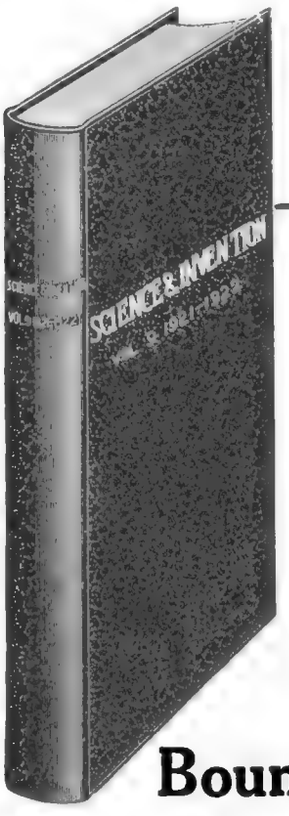
"We shall succeed," declared Ameena. "We must never think but that we shall."

Thus, always, woman's stronger hope and courage never flag.

The run to Uranus occupied some 28 hours—an average velocity of a trifle over 39,000,000 miles an hour. It was about noon of the following day when, after no particularly unusual incidents—Sir Isaac again slowed down for them to make observations.

It had grown colder steadily; the vehicle's heating plant was in active operation. The Sun had dwindled to a little blazing point among the stars.

All that morning the travelers had sat looking downward, watching Uranus grow from a brilliant star to a little moon; from



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moon to glowing silver-green disc. And now, at noon when they slackened their fall, the seventh Planet of the Solar System lay beneath them.

After Saturn, the sight was disappointing. Uranus, 32,879 miles in diameter, lay perfectly barren. Its axial motion, observed closely over a period of time, was distinguishable—like the minute hand of a clock that creeps slowly forward. Sir Isaac believed it to be of some six or eight hours duration.

Heavy banks of cloud masses obscured the Planet's surface; Sir Isaac had not believed Uranus would prove to have an atmosphere—but it had, and a very dense one obviously. But the surface of the Planet itself, what little they occasionally could see of it, was obviously liquid.

URANUS NOT INHABITED

"No inhabitants here," said Sir Isaac. Quite evidently he was tremendously disappointed, for he knew that the average density of Uranus was not much more than that of Jupiter, and he had hoped that in this instance the Jovian interpreter had been lying.

"No inhabitants here," Tubby echoed sadly. "Well, let's get on our way."

Between the orbits of Uranus and Neptune there lies a mean distance of 1,011,796,000 miles—that is to say, something over a thousand million miles. Neptune now, however, was unfortunately very much further along in its orbit, so that the oblique course necessary to reach this latter Planet lengthened the distance to nearly eighteen hundred million miles. Sir Isaac, after a very abstruse calculation, announced the exact mileage to be seventeen hundred, and ten million and twenty-six.

Tubby was getting used to these gigantic figures, which as anyone can realize, are only relative. Sir Isaac pointed this out clearly.

"On Earth, in a railroad train," he said, "if you were going at the rate of fifty miles an hour and had a journey of 1,710 miles to make, it would not be very confusing to fathom the figures, would it? Or to calculate how long it would take you to make the run? That is exactly comparable to this run we have before us now, from Uranus to Neptune. We have about 1,710 million miles to go, and I propose to average about 50 million an hour."

Here Sir Isaac fell back upon one of his favorite topics. "All distances are relative to other distances. A mile to a snail is a long trip, but an airplane makes it in two or three dozen seconds. There is no such thing as absolute distance—or absolute motion, or time or size. Everything is relative to something else. Twenty-four hours is a very little time in the life of an elephant—but it is more than a life-time to many insects. Our trip from here to Neptune is not more than an inch in all the countless miles of space. . . . But I'll tell you more about that some other time."

"Right," said Tubby, considerably relieved. "Just now we got to eat. Ameena's got lunch all ready."

The flight to Neptune occupied just thirty hours—an average of 57 million miles an hour. Sir Isaac was intensely pleased, though as he admitted to Tubby, the real velocity of the vehicle had never yet been tested.

Tubby and Ameena were also enthusiastic.

"Wonder what become of them Mercurians who was after us?" Tubby speculated. "Swell chance of them gettin' way out here."

"They must have stopped at Jupiter," said Ameena. "We were gone then—they could not tell where."

(*Continued on page 609*)

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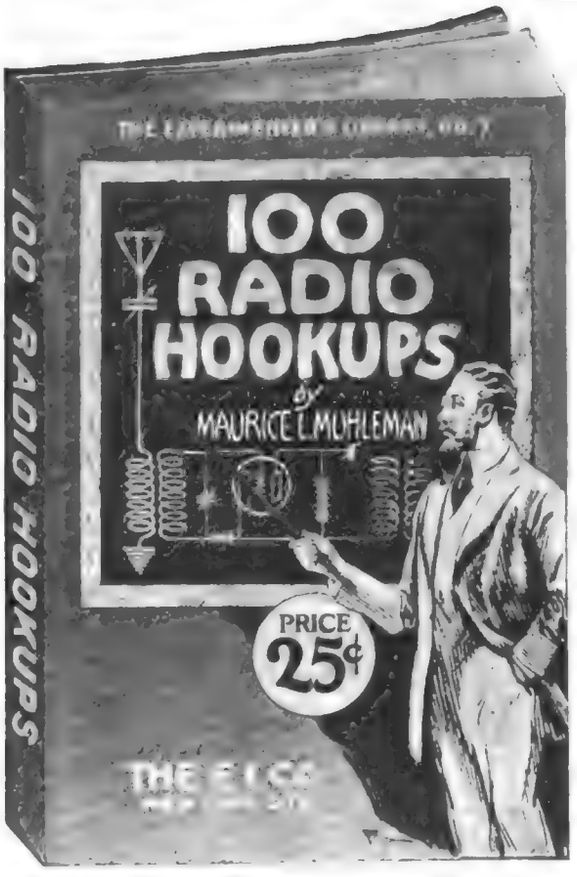

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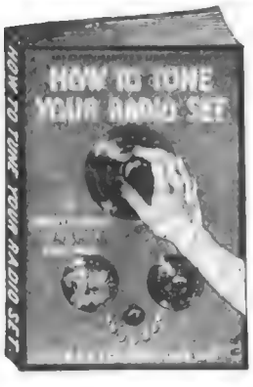

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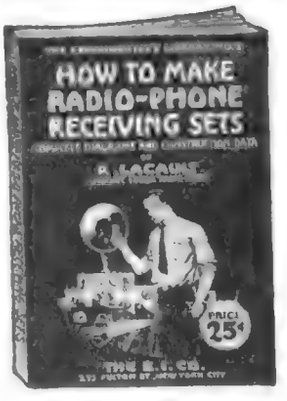

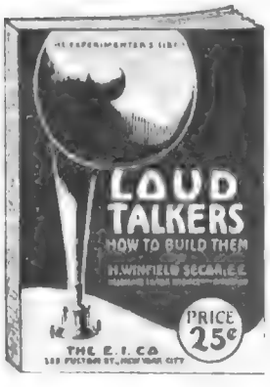

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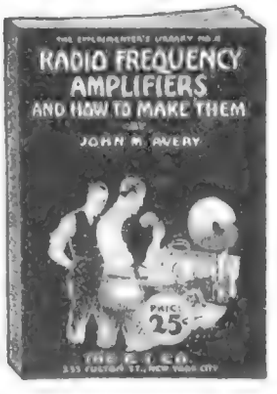

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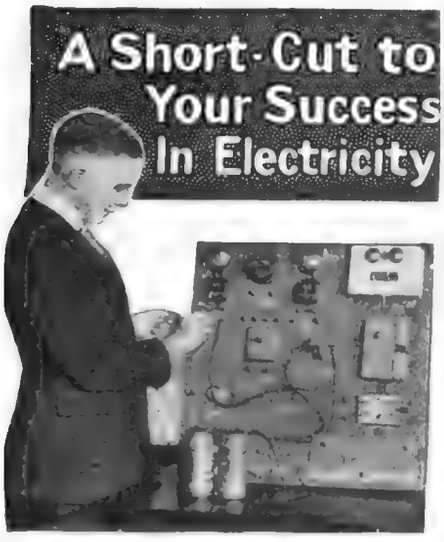

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Around the Universe

(*Continued from page 607*)

This obviously, was logical. At all events, the Mercurian vehicle was now the least of their worries. Neptune lay beneath them. Would they secure, on this far outpost of the Solar System, the help they needed? Fervently they prayed so, for it seemed their last chance.

THE SKY FLIERS APPROACH NEPTUNE

It was just 6 P. M., on the day following their departure from the vicinity of Uranus, when Sir Isaac held the vehicle poised above the surface of Neptune. The Planet, very slightly smaller than Uranus, lay completely enveloped in its dense atmospheric envelope.

"We got to go down," said Tubby frowning. "Can't see nothin' from way up here."

The descent through Neptune's atmosphere was pleasurable, for the friction warmed the vehicle once more to comfortable temperature. At an altitude of some fifteen thousand feet they emerged from the dense cloud-banks into Neptunian daylight. And what a dim, miserable daylight it was! And below, what a bleak, dreary sight met their disappointed gaze! With sinking hearts—their last hope gone—they stared downward. Neptune's surface—flat unmarked by a single distinguishing physical conformation—might have been the surface of a polar sea! In all directions, to the circular rim of the raised horizon, stretched a level surface of grey-white snow, dirty-looking in the twilight which was Neptune's day. But whether land lay beneath, or merely some frozen liquid, could not be told.

There was not a sign of life—nothing but bleak desolation. It was an amazing sight—an old world seemingly, when everything in the logic of Sir Isaac's scientific mind had led him to anticipate a new one—a world of heat, of liquid or gas turbulent from its own internal fire.

Sir Isaac muttered to himself. Looking upward through the side window with Tubby, they saw the Sun through a rift in the clouds—a tiny pencil-point of light in the dull, reddish-blue sky—a dreary, remote Sun, hopelessly impotent to light or to warm this far-away off-spring.

Tubby's face was solemn as he turned to his friend.

"Ain't no use goin' down no farther. That's our finish—that put's our Earth out of business."

Silently the vehicle, with its three saddened, frightened occupants, ascended through the Neptunian atmosphere, again into space.

"Well," said Tubby finally. "Now what? That's the end, ain't it?"

Again it was Ameena who first recovered her courage. Her lips were compressed; her beautiful, dark eyes blazed with determination.

"It is *not* the end, my friends! To such men as you the end never comes before defeat!"

She pointed to the Stars blazing outside the window—the band of "Milky Way," a myriad stars brighter now from this outer edge of the Solar System—and added:

"*There* are other worlds—countless other worlds. Let us go to them! With all the haste we can make—forgetting danger to ourselves—let us hurry. Here at home, in our own little Solar System, we have been rebuffed. But somewhere in this Universe there must be humans who are unselfish—

(*Continued on page 611*)

Earle E. Liederman
as he is to-day

Gee! But It's Great To Be Healthy

Up in the morning brimming with pep. Eat like a kid and off for the day's work feeling like a race horse. You don't care how much work awaits you, for that's what you crave—hard work and plenty of it. And when the day is over, are you tired? I should say not. Those days are gone forever. That's the way a strong, healthy man acts. His broad chest breathes deep with oxygen purifying his blood so that his very body tingles with life. His brain is clear and his eyes sparkle. He has a spring to his step and a confidence to tackle anything at any time.

Pity the Weakling

Don't you feel sorry for those poor fellows dragging along through life with a neglected body? They are up and around a full half hour in the morning before they are half awake. They taste a bit of food and call it a breakfast. Shuffle off to work and drag through the day. It's no wonder so few of them ever succeed. Nobody wants a dead one hanging around. It's the live ones that count.

Strength Is Yours

Wake up fellows and look the facts in the face. It's up to you right now. What do you plan to be—a live one or a dead one? Health and strength are yours if you'll work for them, so why choose a life of suffering and failure?

Exercise will do it. By that I mean the right kind of exercise. Yes, your body needs it just as much as it does food. If you don't get it you soon develop into a flat-chested, narrow-shouldered weakling with a brain that needs all kinds of stimulants and foolish treatments to make it act. I know what I am talking about. I haven't devoted all these years for nothing. Come to me and give me the facts and I'll transform that body of yours so you won't know it. I will broaden your shoulders, fill out your chest, and give you the arms and legs of a real man. Meanwhile I work on the muscles in and around your vital organs making your heart pump rich, pure blood and putting real pep in your old backbone. This is no idle talk. I don't promise these things—I guarantee them. If you doubt me, come on and make me prove it. That's what I like.

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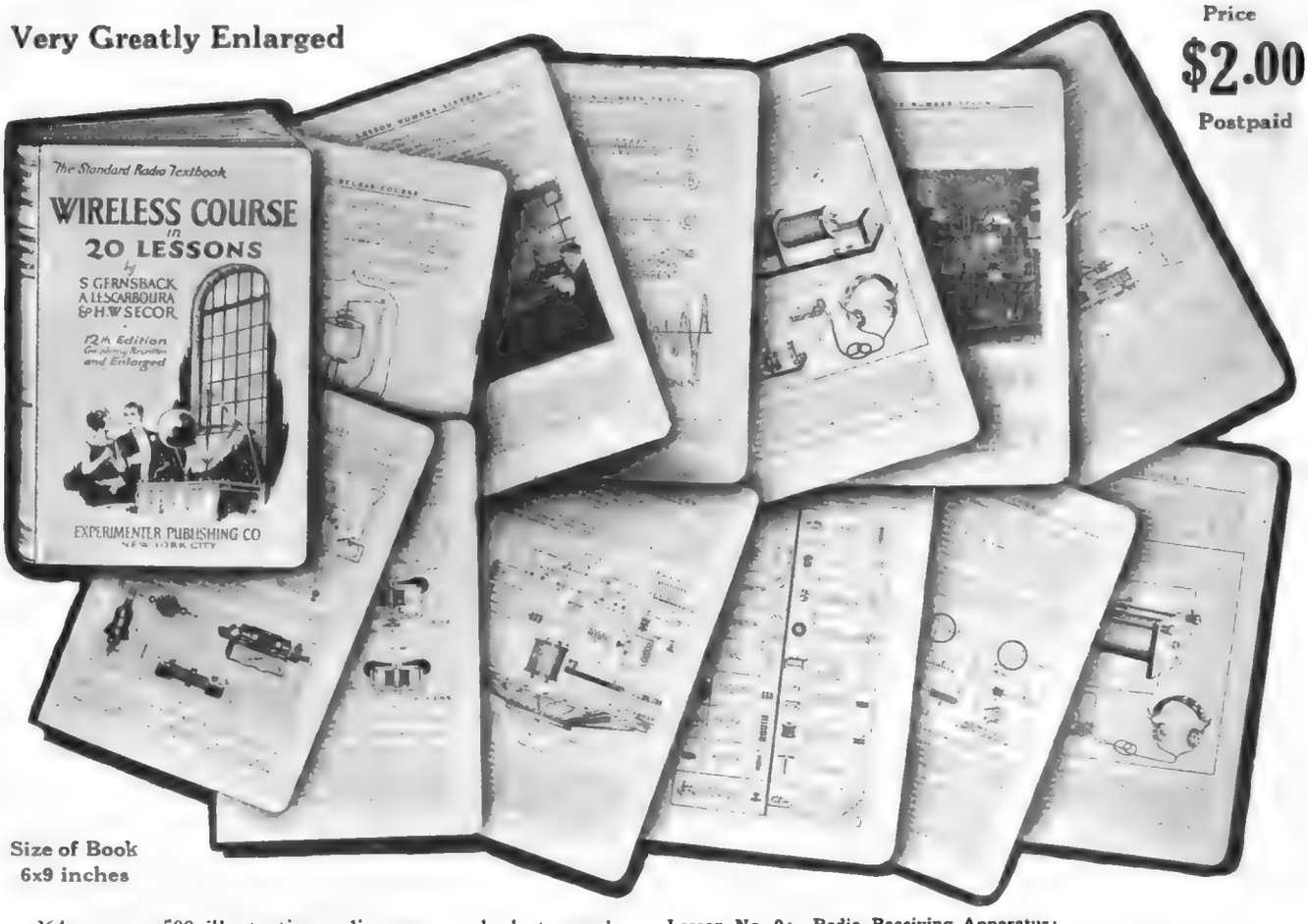

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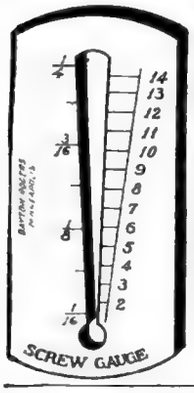

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Around The Universe

(*Continued from page* 609)

who though without hope of reward, still will not suffer their own kind to go down into disaster and death!"

Her enthusiasm was contagious.

"Come on!" shouted Tubby. "Let's get goin'! There's a big star—let's go to that one!"

Sir Isaac thumped his fist on the table.

"We will!" he exclaimed. "I shall attain a velocity never before even imagined! We must—we shall find help for our Earth."

A few moments later, sweeping circularly around Neptune, the undaunted adventurers left the Solar System behind them and launched themselves boldly out into the uncharted realms of Inter-stellar Space!

CHAPTER VIII

IN WHICH, EN ROUTE TO ALPHA CENTAURI, SIR ISAAC EXPLAINS THE STRUCTURE OF THE UNIVERSE AND PLUNGES INTO THE MOST ABSTRUSE MATHEMATICAL CALCULATION EVER ATTEMPTED BY THE HUMAN MIND.

"We must not rush into this thing thoughtlessly," Sir Isaac declared, when the first flush of their enthusiasm was passed and practicality began to creep in. "We must plan—calculate. Our time is limited. We only have—"

"Fifty-two days exact," Tubby finished. "How far we got to go? Ain't we gone a good ways already?"

Sir Isaac had made several brisk computations a few moments before. Neptune, with the entire Solar System behind it, already hung far above them. They were falling downward, apparently toward a very bright Star which gleamed amid a myriad of its fellows in the lower firmament.

"We have relatively a very great distance to go," said Sir Isaac, answering Tubby's question. "We are already on our course to the nearest of all the Stars—and fortunately we happen to be at that extremity of the Solar System nearest to it." He pointed to the lower window.

"Very good," approved Tubby as usual. "The closest Star. Very good. What's its name an' how far away are we? An' say, what's a Star anyway? We been dealin' in Planets so long—"

Sir Isaac smiled. "To answer your last question first, I shall have to give you a brief explanation of the nature of the entire Universe."

Anticipating a somewhat lengthy dissertation of the sort Sir Isaac seemed to delight in, Ameena settled herself beside Tubby and gave him her hand to hold.

"Go on, Sir Isaac, please do," she pleaded.

"Go ahead—shoot," said Tubby.

Thus encouraged, Sir Isaac began:

"The region we call Space is a limited area whose boundaries I shall explain some other time. You have not read my book about the 'Golden Atom,' I assume?"

Tubby and Ameena expressed their regrets.

Sir Isaac frowned slightly. "Oh well—that is immaterial. In that scientific narrative I dealt with infinite smallness, and now we are dealing with infinite largeness. The theory is the same. . . However, this region we call Space is devoid of air. It is not, of course, a vacuum, but is completely filled by the ether."

"What's that?" demanded Tubby.

"The ether, my friends, is an agglomeration of imponderable atoms, which, relatively to their small dimensions, are as far removed from each other as are the Celestial bodies in Space. It is these atoms which, by their vibratory motion, produce both light

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and heat in the Universe. . . That's my own definition. I hope you like it?"

"It's—it's beautiful," declared Ameena.

"Thank you," replied Sir Isaac, smiling graciously. "I think it *is* rather neat. I've used it frequently. Though lately, these foolish modern scientists of Earth are beginning to dispute me. . . Well, to proceed. In this region of Space, billions upon billions of Celestial bodies are whirling. They all obey recognized laws of Celestial mechanics—all are acted upon by different balancing forces. . . I shall not weary you with that."

"No," said Tubby. "We'll pass that up. Go on."

"These Celestial bodies range in size, from the most gigantic blazing Suns, millions of times the volume of our own Sun of the Solar System, down to the very minutest fragment—which is nothing more or less than an atom of the ether itself!"

"We call these Celestial bodies by different names. A Star, for instance, refers to luminous bodies. Our own Sun is one of them. Planets are reflecting, or partially self-luminous bodies revolving around a central Sun. You already understand what Satellites are. Then there are Asteroids, which are merely Planetoids—smaller Planets. And there are Comets, and Meteors, and—"

"Never mind all them," Tubby interrupted hastily. He squeezed Ameena's hand consolingly as Sir Isaac plunged on:

OTHER WORLDS THAN OURS

"Therefore, you understand, we live on one of the Planets—I beg your pardon, Ameena—on two of the Planets of the Solar System—the Earth and Venus. Our Sun, with all its Planets, forms only *one* System of an infinite number. Each of those Stars —" He waved his hand again toward the window—"Each of those Stars very probably has revolving about it a system of worlds much greater than our own 'Solar System.'"

"My goodness," Tubby commented. "This here Universe is a big place, ain't it? We only got started, so far."

The memory of those fifty-two days of grace which were all that remained to them, struck Tubby forcibly. He added anxiously:

"How soon do we get to this first Star, perfessor?"

THE SPACE FLYER IS HEADED FOR ALPHA CENTAURI—THE NEAREST STAR

Sir Isaac referred to a memorandum. "The nearest Star to the Solar System is Alpha Centauri," he answered. "The Astronomers of Earth recently claim to have found one slightly nearer, but *I* do not recognize it. That is Alpha Centauri we are heading for—a splendid binary of the First Magnitude, with a parallax of 0.75" whose components revolve in 81 years. I mean—" he added apologetically, "it is really two Stars several hundred million miles apart, revolving around each other. It is drifting through Space with a velocity of some sixty miles a second."

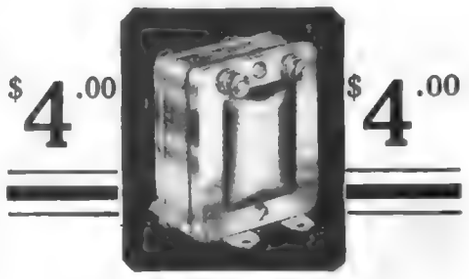
Tubby lifted his eye-brows; Sir Isaac continued hastily:

"Every Star is moving—drifting, I call it—as though they were in gigantic currents circulating about—I don't know just whither or why. Our own Sun, for instance, with all its Planets, is drifting—floating toward some of the Stars and away from others—at the rate of many miles a second, but always holding its mass of Planets intact."

Tubby turned to the girl beside him. "Kind of complicated, ain't it, Ameena?" Then to Sir Isaac:

"How far *is* this closest Star we're headin' for? I ast you that, an' you—"

"I was getting to that. But if you *must* know at once—" Sir Isaac spoke with some asperity. "If you insist, I'll tell you that Alpha Centauri is a trifle less than 25,000,000,000,000 miles from here!"



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Tubby and the girl stared blankly as Sir Isaac stated this astounding figure.

"You see? I knew you would not understand me. What I wanted to explain first, was that in dealing with these larger figures to save confusion we generally use a larger unit than the mile. The best one is the Light-year. It is the distance light travels in a year."

"How far?" Tubby asked, with rapidly recovered poise.

THE PROFESSOR EXPLAINS MEANING OF LIGHT-YEAR

"Light travels about 186,000 miles a second," said Sir Isaac. "Multiply that up to a year and divide it into 25,000,000,000,000 and you get 4.35. A child could do that by simple arithmetic. Thus you find that Alpha Centauri is distant 4.35 Light-years."

This latter figure was considerably less awe-inspiring. Tubby seized it eagerly.

"Only four Light-years. That ain't so far."

"No," said Sir Isaac, smiling with returned good humor. "Comparatively speaking, of course, it isn't far. All distance is relative. If you can travel fast enough, 4.35 Light-years, especially compared to the many hundred Light-years which separate some of the Stars, is relatively quite near. . . . Now about our own velocity—"

It was, in truth, the problem of attaining a sufficiently great velocity to cope with these greater distances that had worried Sir Isaac from the moment they decided to launch out into Inter-Stellar Space. Within the comparatively narrow confines of the Solar System—menaced by Asteroids and Meteors—a great velocity was neither necessary nor desirable. But now—in the outer realms—it was both.

Sir Isaac, in spite of his bombastic statement to Tubby as they left the Earth, had never really anticipated a prolongation of the voyage beyond Neptune. Nevertheless he had always believed that the vehicle's velocity, theoretically, was illimitable. Several factors contributed to this conclusion. It is one of the laws of motion, inertia to be exact, that a body once in motion and not acted upon by any force, will continue

(*Continued on page* 615)

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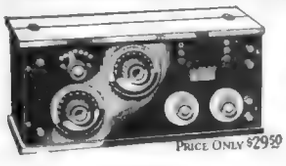

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Around the Universe

(*Continued from page* 613)

forever in motion at exactly its original rate. Thus, whatever force was applied to the vehicle must *accelerate* its rate of speed indefinitely.

The entire Solar System now lay above them, and thus the combined repellent force of all its Planets and its Sun could be used. This, with the attractive force of all the countless gigantic Stars that lay below, Sir Isaac was confident would cause them to fall into the void of Space with tremendous velocity—a velocity that had no limit except the time allowed for acceleration.

Haste was needed, and now, for the first time since leaving the Earth, Sir Isaac used almost all the total force at his command. They had left the vicinity of Neptune about 8 P. M. At midnight, just when the sleepy Ameena was about to retire, Sir Isaac looked up from the most complicated calculation he had so far made.

SPEEDING THROUGH SPACE AT 200,000 MILES PER SECOND

"Our velocity is now approximately two hundred thousand miles a second," he announced triumphantly.

"Thousand!" Tubby exclaimed in dismay. "We was goin' in millions this afternoon!"

"I said a *second*," Sir Isaac returned. "We did attain—at one short period last night—about a hundred million miles an hour. But I cut it down at once. This is per second—not per hour."

"Oh," said Tubby with relief. "How much is that a hour?"

"About seven hundred and twenty million—that is to say, seven times our former maximum."

This was joyful news indeed; but Sir Isaac's next words dispelled the joy completely.

"At this rate," he added, "we should reach Alpha Centauri in about four years!"

And in fifty-two days Mars would destroy the Earth unless they were back there to prevent it!

"But—but then—" Tubby protested. Sir Isaac's quiet smile stopped him.

"You need not worry over that," he said. "There are many forces acting upon us which you do not understand. The acceleration of a falling body is in astounding ratio—especially when it has an additional repellent force above it. . . . I've told you that before. Wait until tomorrow—then we shall see."

There followed a somewhat lengthy silence.

"Say, perfessor," Tubby began finally, "ain't this kind of re-*mark*-able—this extra speedy travelin'?"

Sir Isaac looked up from his mathematics. "My dear fellow, I *do* suppose these Astronomical figures confuse you. I've already tried to explain—"

"No—I mean, *us* bein' able to go so fast."

Sir Isaac laid aside his pencil, and frowned. "I see nothing extraordinary in it. Your mind is still in its Earth-rut. You must get out of *that* line of thinking."

"I will," Tubby declared humbly. "Only tell me how to."

Sir Isaac's good nature returned, promptly as usual. He laughed.

"You must understand that on Earth you have always been dealing—personally, I mean, with mileage the longest distance of which is the circumference of the Earth—25,000 miles. All your life you have been a little ant, chained down by gravity. Naturally, for you, motion has had a very narrow meaning. Your own motion, in relation to the ground beneath you, is all your mind daily recognized. That, for you, was the standard of motion.

"But, my dear friend, that is not really motion at all. You were like an ant, crawl-

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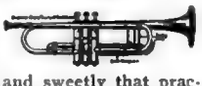

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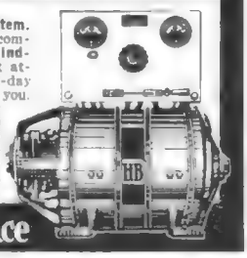

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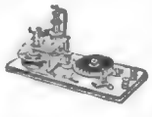

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ing around the narrow limits of its little world. How can you expect an ant to understand, or to fathom the velocity of an airplane, or a rifle bullet, which covers in a fraction of a second, a space—a distance—equal to the entire known world of the ant?"

Sir Isaac was gradually warming up.

"You call that motion. On the other hand, though you did not know it, perhaps, both you and the ant have always been moving with great rapidity. For instance, the rotation of the Earth on its axis, if you happened to be on the Equator, would carry you around a circle of 24,000 miles in one day—every day. That is a thousand miles an hour. Added to that, the Earth also moves around in its orbit some 66,000 miles an hour. Still more than that, the Sun drags the Earth along at about 36,000 miles an hour. This motion of the Sun can only be calculated by its relation to the other Stars. And, so far as *I* know, the whole Universe may be hurtling through Space a thousand times that fast. In fact, I think it is. And still more than *that* probably Space itself is moving—a million times faster than everything else. . . . But that you cannot understand yet. . . . I'll explain *that* to you later."

"Tell me more," Tubby murmured desperately.

"Well," said Sir Isaac, "in Space you see, all Earthly ideas of motion must be reconstructed. We are now a Celestial body ourselves—obeying all the laws of Celestial Mechanics—a little world all our own—a world of three inhabitants."

It was an interesting thought; it aroused in Tubby a sudden patriotism for the vehicle and its welfare.

Sir Isaac went on quietly and earnestly:

"Some of the Stars are drifting at the rate of 250 miles a second. *Drifting*—you understand. But we are not drifting, we are *falling*—pulled down by attraction from below and pushed down by repulsion from above. Is it any wonder then—after falling freely for millions of miles, and with such a constant, tremendous impulse—that we should attain an enormous velocity?"

Both Tubby and Ameena admitted the reasonableness of this. Motion, as Sir Isaac so clearly pointed out, depended entirely upon the motion of something else with which you compared it.

"I guess it ain't so wonderful, perfessor," Tubby said finally. "But you got to get used to thinkin' about it."

Sir Isaac smiled, and turned to the tired girl. "Hadn't you better run along to bed, Ameena?"

Tubby escorted her to the foot of the stairs. As he parted with her for the night, she said softly:

"Do not worry, Tubby dear. We shall succeed—I know it."

With a radiant smile she kissed him goodnight and darted up the stairs. For an hour thereafter Sir Isaac's figures fell upon deaf ears; the memory of Ameena's beautiful face and the tenderness in her voice—attributes that had all the inherited intensity of hundreds of Venus-women ancestors behind them—absorbed Tubby's entire consciousness.

During the night, Tubby and Sir Isaac alternated keeping watch, though as usual Tubby did most of the sleeping. Poor Sir Isaac was getting thinner than ever; but his wonderful courage and vitality held him up. He was almost always either working with his calculations, or using some of the many scientific instruments with which the room was equipped; and, for diversion, writing his manuscript, which hourly grew in bulk.

THE PROFESSOR WRITES A NARRATIVE OF THE TRIP

He was engaged in this latter occupation the following morning after breakfast, when Ameena, coming in from washing the break-

fast dishes, timidly asked him what he was writing. He looked up to her with tired eyes as she and Tubby, with arms around each other, stood beside him.

"I am writing a scientific narrative which I think I shall call 'Around the Universe'," he said quietly.

Ameena clapped her hands. "Oh, isn't that fine? All about our trip! Will you publish it on your Earth? Everyone will love to read about all these wonderful things. won't they?"

Sir Isaac's smile was very gentle, slightly cynical.

"My dear child," he said, "you do not understand human nature. People may condescend to read what we have done, but do you think they will *believe* it?"

"But, of course, they *must*," the girl cried. "Is it not actually happening to us?"

Sir Isaac sighed. "It is, most certainly. But people are so skeptical. They do not even believe that Jupiter is habitable. They will think I made it all up—treat it as a joke. All my scientific data—my personal observations—the most wonderful Astronomical—"

"Let 'em go to blazes," Tubby put in fiercely. "We'll give it to Venus. If them Earth-people ain't got no more sense than—"

"But first we must save the Earth-people, or those terrible Martians will destroy them," reminded Ameena.

Tubby sobered. "That's so." Another thought struck him. "We'll save all them Earth-people from gettin' murdered—an' then they'll laugh at us for tellin' them how we did it! That's gratitude for you! That's —"

Ameena kissed him gently. "Never mind, Tubby. We shall do what we can—for the sake of humanity—without hope of reward."

Sir Isaac, practical as always, remarked somewhat cynically:

"To accomplish that, we must have help. We must find some other humans in this Universe as unselfish as ourselves. Can we do that? I doubt it."

"You are extreme, Sir Isaac," Ameena said. "On your Earth, when you have had war, have not Nations aided each other?"

"Yes," he answered. "But only for their own interest—for their own defense. I cannot recall a single instance of real unselfishness. Yes, I think there were two. A few years ago there was a little Nation—"

"A little Nation!" Tubby exclaimed. "Say, maybe that's the answer! Maybe we was wrong to pass up all them little Planets between Mars and Jupiter!"

"I thought of that," Sir Isaac responded. "A small Nation or a world, I think, is more likely to be completely unselfish. I don't know why it should be so—but it seems to be. There are Ceres, Juno, Pallas—many Minor Planets—and we ignored them all." He shrugged. "You see, a little world, however willing, would be powerless to help us materially anyway—even if they wanted to. That is why I did not consider them."

The train of thought which this conversation brought to Sir Isaac worried him afterward very considerably. In drawing an analogy between individual Nations and Planets, it became perfectly clear that to ask aid of any Nation is a very different matter from going to another world. Nations on the same Planet have infinitely diversified interests interwoven. War comes. However unselfish a Nation may appear—may in fact really and sincerely in its heart feel itself to be—it cannot by the very nature of things, be wholly detached. But go to another Planet. The detachment is complete. Then—and then only—can you put the real test of altruism.

Thus the identical attitudes of the people of the Light Country of Mercury, and of Venus, and Jupiter, while they cannot be condoned, at least can be understood. And following this train of thought, as Sir Isaac

(*Continued on page* 619)

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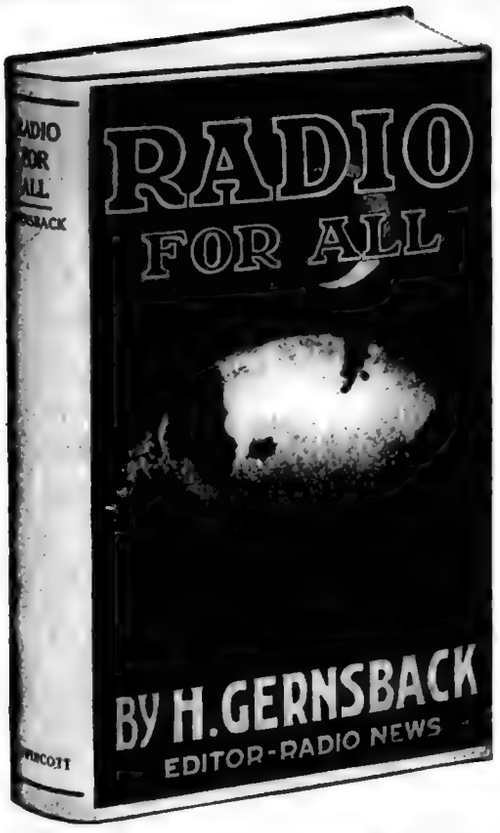

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Around the Universe

(*Continued from page 617*)

did that morning while he sat staring with unseeing eyes at his neglected manuscript, an additionally disturbing conclusion was inevitable.

All the Planets the voyagers had so far importuned, belonged to the Solar System. To some extent, therefore, their theoretical interests were mutual. And, if Mercury, Venus and Jupiter were willing to stand by and see the War Lords of Mars overrun the Earth, how much more likely were worlds far outside the Solar System to adopt a similar attitude? Sir Isaac pondered this, until at last he began to realize how inevitable would be their rebuff, no matter where in the Universe they went.

Noon came. Sir Isaac ate moodily, then went back to the instrument room and his gloomy reverie. Ameena put the kitchen in order with Tubby's help, after which the two young people sat in the store-room, Ameena strumming her lyre and Tubby singing with enthusiastic abandon.

It finally became too much for Sir Isaac's overwrought nerves.

"Won't you *please stop?*" he called querulously. "I can't *stand* that infernal noise when I'm thinking."

They stopped obediently; and a moment later joined Sir Isaac.

"How we makin' out perfessor?" Tubby asked timidly. "We're sorry we disturbed you—this here house is so awful quiet."

Sir Isaac was never one to hold rancor.

SPEEDING ON AT 45 MILLION MILES PER SECOND

"We are doing very nicely. Our per second velocity now is approximately 45 million miles. At this rate we would reach Alpha Centauri in about six days. I shall, however, do much better than that—our rate of acceleration is quite satisfactory."

But Sir Isaac only shook his head and went back to his reverie.

It was a futile thing—Sir Isaac smiled cynically to himself as he thought of it. The Stars themselves would not be inhabited since they were blazing Suns. Hope only remained with their individual Planets; and to locate these Planets and land upon them would consume much more time than the meagre 51 days of grace that were left.

A very real problem of Celestial Mechanics showed Sir Isaac the mathematical impossibility of landing upon more than two or three additional Planets at the most, in such a time. The vehicle, during these many hours that Sir Isaac had remained lost in thought, had accelerated to a velocity of some two hundred million miles a second—enough to take it far beyond Alpha Centauri in a very few days—especially since the acceleration was constantly progressing. But more than twenty-four hours had been consumed in attaining this velocity; and to check it entirely, under similar conditions would require an equal length of time. But suppose Alpha Centauri had no planets? Or suppose the Planets were not inhabited? To go to the next nearest Star would require many days more—a still higher velocity—a still greater loss of time in starting and stopping. And then the actual time necessary to land upon a Planet—the slow descent through its atmosphere—the ascent, and hours afterward proceeding at a snail's pace such as they had used within the Solar System! No, it was impossible. A year would be required to make any extended exploration—a year at the very least.

"I *will* figure it out," he muttered grimly. "The most delicate, abstruse mathematical problem ever attempted! But it *can* be solved—and I will—I *must*—solve it.

(*To be Continued.*)

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What They Say About RADIOGEM

I am enclosing herewith $1.00 to pay for the Radiogem. I had it carefully wound by our wireless operator and find that it works beautifully—fully as good as any crystal set we know of.

Radiogem received, which we assembled and were very much astonished at results obtained and the clearness and volume of tone produced.

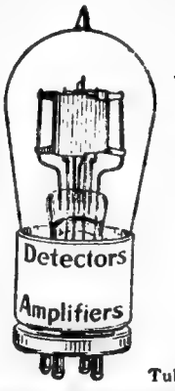
The greatest distances I heard on one of your sets is 1000 miles, having heard WGY at Schenectady, N. Y. I think your set is the best I have ever sold at any price.
On an aerial 160 feet long and 20 high one of my customers has heard WOC and WHB, KSD, WMC on one of your sets using a Peerless headset.

Herewith P.O.M.O. amt. $1.00 for another "RADIOGEM." The one received is O.K. Placed about 15 ft. of picture cord under front porch and grounded to a gas meter, and heard the Sacramento Bee and Sacramento Broadcasting Union much better than with my large crystal set.

Your RADIOGEM RECEIVER is a wonder. I have received every station in Philadelphia with it much louder than with a high-priced crystal set.

Your two Radiogem sets received last night, and one was wired up for testing. WOC is about 40 miles away, and their signals could be heard with headphones on table. After they quit KYW at Chicago about 170 miles east was heard. Every word could be plainly heard here. WMC at Memphis, Tenn., could also be easily heard and understood.
We find that this set does a great deal more than you claim for it. We took WEAR on our audion set last night; this being the Baltimore American Broadcasting station, and then cut in the Radiogem and got excellent results. After the Baltimore concert was over, we continued to use the audion set and about ten o'clock were listening to WEAF—New York—and a little later we disconnected the audion set entirely and hooked up the Radiogem, very clearly hearing both piano music and announcement of name of station and its location.
You claim a radius of 20 miles over your "Radiogem" is sometimes a possibility. You should adhere to the truth. I constructed one for my mother, installed it with an aerial, and she listens not once in a while, but at her will, to Schenectady, Newark, New York, or Providence, R. I., and her home is Attleboro, Mass. I can't give your set too much praise.

(Names and Addresses on Request)



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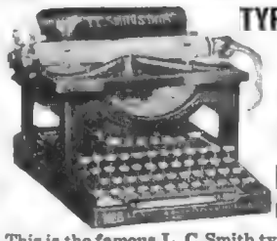

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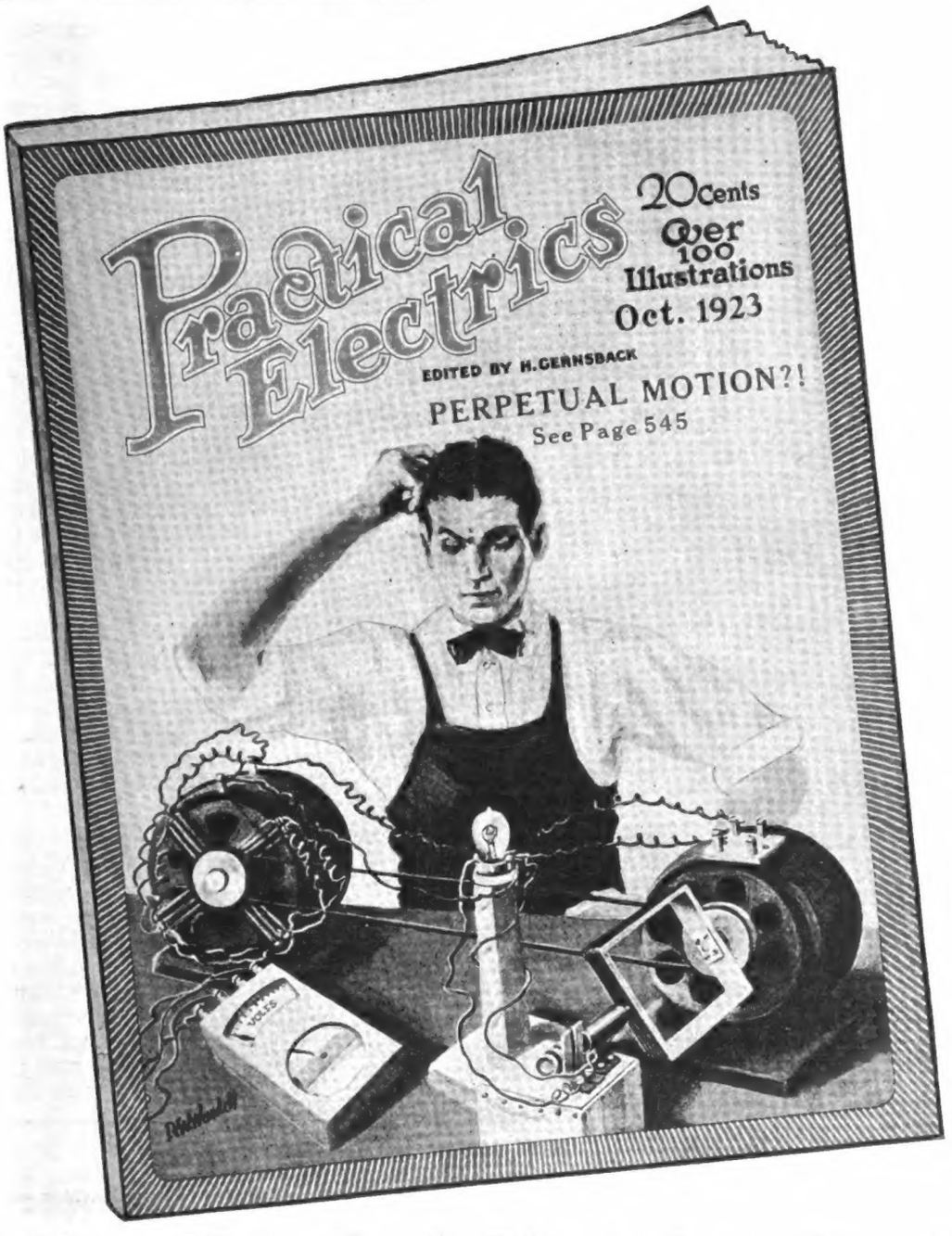

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CHIROPRACTIC *and* Smallpox

By JAMES G. GREGGERSON
National Lecturer for the Universal Chiropractors' Association
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TWENTY years ago compulsory vaccination was taken for granted, but in recent years the movement to abolish it has gone by leaps and bounds in every state in the Union. England, after testing the vaccination theory for more than a century, entirely abandoned it. Dr. Walter Hadwen, M. D., M. R. C. S., of Gloucester, England, speaking on this question at a public meeting in Los Angeles, Calif., June 16, 1922, said:

"Now, my friends, **the whole of this wretched vaccination and inoculation system is based upon superstition!** Thank God, we have carried a law in my country that no one need be vaccinated, and 75 per cent of the children born in the United Kingdom remain unvaccinated. We never had so little smallpox in all our history. It is practically non-existent."

This vaccination idea was tested in Kansas City, Missouri, during 1921, and here are the facts as published by the Advertisers' Protective Bureau of the Kansas City Advertising Club, George M. Husser, Sec'y, 801 Graphic Arts Bldg., Kansas City, Missouri:

"It is the policy of this bureau to deal only in facts. This policy underlies the bureau's work as a quasi-public institution in its mission of suppressing for the benefit of the public fraudulent and misleading advertising or publicity. . . .

"The facts seem to be that health conditions just before the 'epidemic' were favorable, from the less than 50 per cent hospital attendance, the small list of contagious cases on record at the health office (see list) and the fact that E. H. Bullock, health officer, felt the time opportune to take his annual vacation. We learned also that medical practitioners had fewer cases, and were not overrun with calls.

"The sudden calling of the epidemic and the attendant publicity changed all this. Every medical practitioner in the city found his hands full with vaccinating patients, both at the office and in the homes. Unofficial estimates place **the number of** paid vaccinations (as distinguished from free vaccinations of school children and at health centers) at 200,000, for which it is alleged fees ranging from 25 cents up to $5 each were charged. An estimated average fee of $2.50 would yield an aggregate of one-half million dollars expended by the public of Kansas City during this period for vaccination alone. Besides the vaccination expenditure many people suffered from the after-effects of vaccination, some of them severely. For these, medical attention was required, in some instances over a period of months, with added expenditure. Besides, there were numbers who, from reading of the epidemic, imagined they had the symptoms of smallpox and desired medical advice, which added to the cost. This phase need not be entered into at length, the above outline being, we believe, sufficient to emphasize our point."

The vaccination theory was also put to the test in the Philippine Islands for seventeen years, with the following results as given by the Masonic Observer of Minneapolis, Minn., issues of Dec. 17th, 1921, and of Jan. 14th, 1922. This paper is the publication of the Free Masons, a body of gentlemen than whom there is none greater.

"Sixty thousand, six hundred and twelve cases of smallpox, and 43,294 deaths from smallpox in the Philippines in 1919. . . .

"We were unable to secure a 1919 report of the Philippine health service, and this is not surprising in view of a discovery made in the report of that organization for 1920, tucked away in one small paragraph on page 24 of the report, which discloses that the smallpox epidemic of 1918 continued during 1919 with a total of 60,612 additional cases and 43,294 deaths for 1919. . . .

"The Philippines have experienced three smallpox epidemics since the U. S. first took over the islands, the first in 1905-1906, the second in 1907-1908, and the third, and worst of all, the recent epidemic of 1918-1919. Before 1905 (with no systematic general vaccination) the case mortality was about 10 per cent. In the 1905-1906 epidemic, with vaccination well started, the case mortality increased to over 16 per cent. In the epidemic of 1907-1908, with general systematic vaccination going strong, the case mortality ranged from 25 to 50 per cent in different parts of the islands. During the epidemic of 1918-1919, with the Philippine Islands, supposedly, almost universally immunized against smallpox by vaccination, the case mortality averaged over 65 per cent. These figures can be verified by reference to the report of the Philippine health service for 1919, see page 78. These figures are accompanied by the statement that the 'MORTALITY IS HARDLY EXPLAINABLE.' To anyone but a Philippine medical health commissioner it is plainly the result of vaccination."

Not only has smallpox become more deadly in the Philippines, but in addition,

"The statistics of the Philippine health service show that there has been a steady increase in recent years in the number of preventable diseases, especially typhoid, malaria and tuberculosis."

(Quoted from the 1921 Report of the special mission on investigation to the Philippine Islands, of which commission General Leonard Wood was the head.)

Just as a sort of condiment to this mass of facts, let us quote from Physical Culture of June, 1922. It places the facts very briefly as follows:

"IS THERE METHOD IN VACCINATION MADNESS?

"Most **vaccinated** country, Philippine Islands, population 10,350,640, smallpox deaths, 1919, 44,408. Least vaccinated country, England and Wales, population 37,885,242, smallpox deaths, 1919, 28.

These facts admit of no contradiction. Kansas City can be reached with a one-cent postal card, the report of the surgeon general of the Philippines is public property, and the authorities from which Physical Culture quotes are accessible to everyone. It is an established fact that the public has been victimized for over a hundred years by those whose science consisted of getting the cash by frightening the people with repulsive pictures. The injection into your body of the rotten tissue from the sores of a cow with cowpox to prevent smallpox, was a superstition when performed by those who knew no better. Its continuance with the facts established is a crime against humanity.

Chiropractic teaches that smallpox is the result of poisons accumulating in the body because the organs of elimination are not functioning properly. The poisons that ordinarily pass out through the kidneys, bowels, etc., are retained in the body and the 'power within," that throws these poisons out, starts to expel them through the pores of the skin. These pores being closed permit the poisons to accumulate until they produce the eruption peculiar to smallpox.

We teach that the reason the bowels and kidneys do not work right, is because the functional impulse does not reach these organs, due to the fact that a vertebra in the spine is misaligned, thereby impinging the nerve and interrupting the normal flow of these functional impulses to bowels, kidneys, etc.

This adjustment of the vertebrae is the chiropractor's work, and this practice of ascertaining which vertebrae are misaligned by palpation, and adjusting them to normal alignment by hand, is all the chiropractor does. It is upon this simple practice of the palpation and adjustment of the vertebrae of the spinal column with the hands for the purpose of releasing the prisoned impulse, that Chiropractic has made the most astonishing growth of any profession in the history of the world.

Of course, Chiropractic is not the practice of medicine, and of course the real chiropractor is but a demonstrator of an idea. He is not a jack of all trades. Those who do other things beside palpating and adjusting the spine, in the name of Chiropractic, simply adopt the name chiropractor for business reasons. The denser the ignorance of these gentlemen, the more contraptions they use to conceal their ignorance. Those who wish to try Chiropractic should see that they secure a *competent* practitioner, and the service of directing you to the office of a competent practitioner will be performed by the

Universal Chiropractors' Association of Davenport, Iowa

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